RADIO NEWS

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RADIO NEWS

CONTENTS

VOL. 2 FOR AUGUST NO. 2

	PAGE
Radio Photography.....By H. Gernsback	69
The Braun Loop Antenna, By Dr. Alfred Gradenwitz	70
A Unique Static Eliminator.....	71
Japanese Radio Apparatus.....	72
Important Radio Examination Notice.....	72
French Vacuum Tube Instruments, By J. Goussin	73
The Latest Word in British Receiver Sets	73
Radio Music at Asbury.....	74
Concerning Radio Development.....	75
Music Wherever You Go.....	75
Design of a Radio Receiving Set—Part II, By L. M. Clement	76
Unique Electric Wave Model, By R. C. Clinker	78
A Telescopic Quenched Spark Gap, By R. U. Clark, 3d	78
Some Notes on a Good Amplifier, By Louis Funke	79
High Efficiency Spark Gap, By Alfred Lindsay	79
The Radio Constructor.....	80
Vacuum Tube Controlling Units, By J. Stanley Brown	80
The Construction of a Cage Type Antenna, a Feature.....By Lloyd C. Greene	81
Radio Telephony on Aeroplanes, By Major C. E. Prince	82
Twelve Volt Buzzer Transmitter, By D. R. Clemons	84
Anti-Capacity Windings vs. Coil Efficiency, By Oscar C. Roos	85
The Simplest Hook-up, By Thos. W. Benson & Chas. S. Wolfe	86
An Amateur Station in Holland.....	87
Our Boy's Wireless, By Mary Barton Smith	87
Radio Digest.....	88
Club Gossip.....	89
With the Amateurs.....	90
Junior Radio Course.....	92
Dictionary of Technical Terms Used in Radio	93
Junior Constructor.....	94
I-Want-To-Know	95
"It's a Great Game if You Don't Weaken" A Cartoon.....	96

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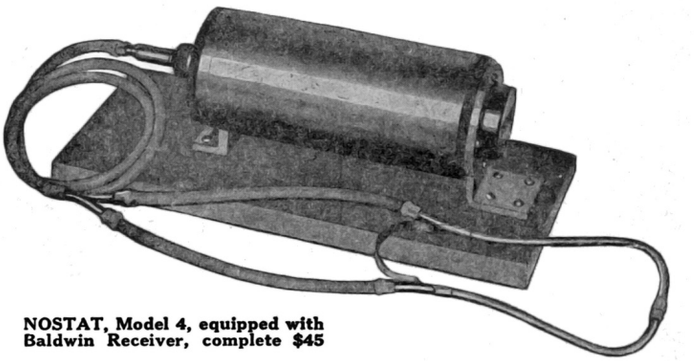

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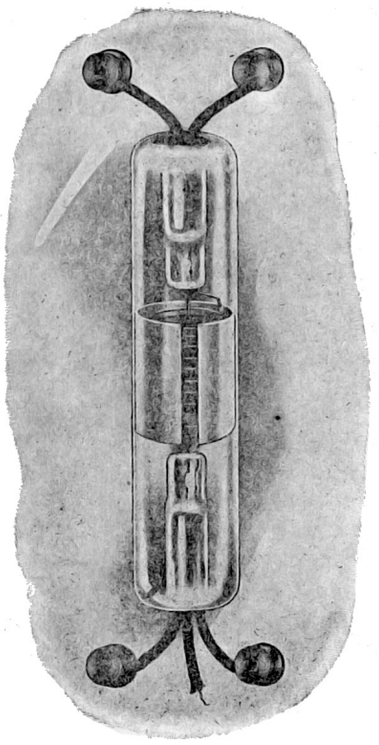

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RADIO NEWS

H. GERNSBACK — EDITOR
PIERRE H. BOUCHERON — ASSOCIATE EDITOR

Vol. 2 AUGUST, 1920 No. 2

RADIO PHOTOGRAPHY

ONE of the least exploited branches of the radio art is no doubt *radio photography,* better known as sending pictures or drawings by wireless.

Of course there is nothing new about this and ever since the days of the coherer, serious efforts have been made to send pictures by radio. As far back as twenty years ago actual experimental apparatus had been used for this purpose and the results in some cases, while mediocre, showed that the thing could be done in a practical manner with better apparatus.

Fundamentally, sending pictures by radio is not much more difficult than sending them by wire. As is well known, Professor Korn, in Germany, as well as other experimenters, have achieved notable results in transmitting pictures over wire, and this art is known as *telephotography.*

In radio, the same principle holds good and the method in a few words may be described as follows: At the sending end a picture or drawing is usually made upon tinfoil or any other conductive surface, the picture being printed in an insulating ink. From this it will be seen immediately that there will be certain areas which are covered with an insulator, while other areas are metallic and consequently conductors. We now take the piece of tinfoil with the picture printed or drawn upon it and wrap it on a metal cylinder. We then rotate the cylinder upon its axis while a metallic stylus presses upon the tinfoil. This stylus advances just exactly as a phonograph needle advances on the old-fashioned cylinder phonograph. It becomes evident that the stylus will at some time travel over the tinfoil and at other times over the insulating ink. If the stylus and the metal cylinder, upon which the tinfoil is wrapped, are connected to an electro-magnet and battery so that it will operate an ordinary telegraph key, then in that case the key will be depressed every time the stylus touches the tinfoil and will likewise be released every time the stylus travels over the insulating ink. From this it will be seen that short or long impulses are sent out from the radio station all depending upon the physical make-up of the picture. After the stylus has completely traveled over the surface of the picture, the latter will thus have been translated into dots and dashes of various durations of time.

If at the receiving end we have an apparatus which runs synchronously with the speed of the cylinder at the sending end, it can be readily seen that if we have a similar stylus with a pencil or pen that a picture will be reproduced by the receiving apparatus, which must in all respects be exactly the same as that which constitutes the picture at the sender. Were it not for the bugaboo of synchronism, there would be very little trouble in thus sending pictures by radio, but here the great difficulty arises. Thus far it has been almost impossible to get two disconnected pieces of machinery to revolve at exactly the same speed for long durations of time. There will always be a certain length of time where the speed of the two machines are not in synchronism with each other, and that means, of course, a distorted picture at the receiving end. Theoretically, it should be an easy matter to send pictures by wireless and there is certainly a great future for this art. Up to the present it has not been exploited whatsoever, and is still in the experimental stage.

It seems, however, that there must be some method by which the trick can be turned without the use of cylinders that must rotate synchronously. In the olden days we were also tied down to a coherer that worked sluggishly and not at all perfectly; this naturally gave rise to imperfect pictures. We are not much troubled with such things in these days of the vacuum tube and once we have overcome static which, of course, now often interferes while sending pictures, we will be on the road toward quickly sending pictures across the continent or even across the ocean without much trouble.

Speaking of various methods of sending pictures, a novel method was used recently in New York, when the representative of an English paper *cabled* a picture of the yacht races to London which picture was reproduced the next day.

No machinery was connected either to the sending or to the receiving side. The English representative merely filed an ordinary cablegram sending nothing but a jumbled quantity of words. In London, these words were "decoded" and were arranged upon a chart in a certain manner. After the words had been thus rearranged the paper chart was re-translated into certain punch holes onto another piece of paper. The distances of the various punch holes were based upon certain words which had been cabled from New York. Thus a picture was built up without much trouble and the next morning London actually saw a picture of the yacht races that originally had been nothing but a confused jumble of words.

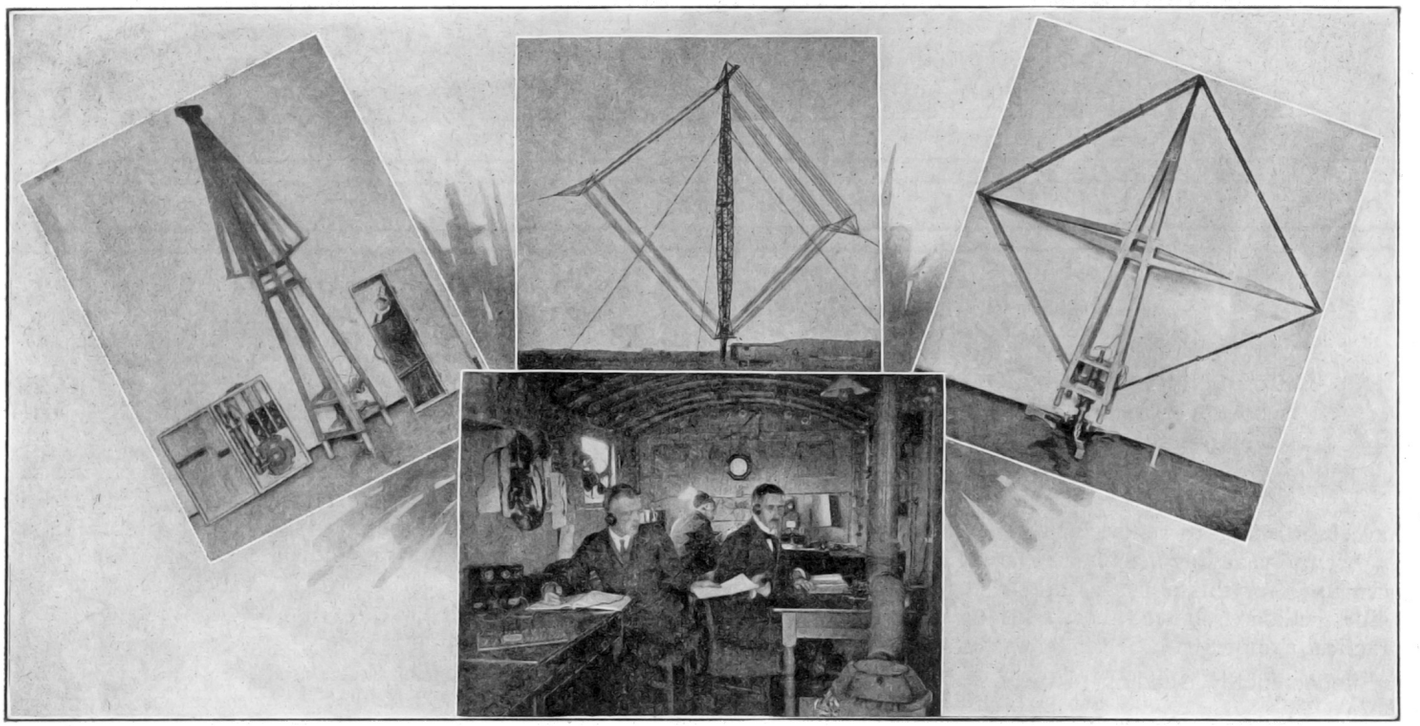
While we understand that this picture which was printed by the London *Daily Mirror* was not free from imperfections, it certainly shows what can be done by ingenious calculation.

It seems to us that there must be many more such methods of telegraphing pictures by radio. To those interested in sending pictures by means of ordinary words such as the one described above, the reader is referred to an article which appeared in the November, 1919, issue of *Electrical Experimenter,* in which this method was described.

H. GERNSBACK.

The Braun Loop Antenna

By DR. ALFRED GRADENWITZ*



In This Interesting Group We Have In the Upper Left Hand Corner a Small Type of German Loop Antenna Folded Very Much Like an Umbrella. In the Upper Center Photograph Is Shown the Immense Double Frame Loop Situated at Geltow, the Mast of Which Is Forty Meters High. One Frame Is Wound to Receive New Brunswick, N. J., the Other to Receive Annapolis, Md. At the Foot of This Unusual Antenna May Be Seen the Furniture Van Which Has Been Converted Into a Receiving Station. The Photograph Directly Beneath Shows the Interior of the Van Which Contains the Provisional Receiving Apparatus. In the Illustration to the Right We have the Same Loop Antenna Shown to the Left, But in This Case It Has Been Opened and Is Ready for Operation. It Will Be Noticed That This Loop Rotates Upon a Vertical Axis.

THE use of closed oscillatory circuits as receiver aerials was first suggested at an early stage of the art by Fessenden, Bellini, Blondel and Pickard, tho the limited range of such arrangements then prevented their adoption to anything like a practical scale. Professor Braun, of Strasburg, while measuring the field intensity of the Eiffel Tower, in 1913, again investigated this type of antenna and, for the first time, it would seem, realized its future possibilities. In the course of the last few years, loop or frame antennae of the type designed by Professor Braun were developed to a remarkable degree of perfection, thanks to the amplifiers designed by the Telefunken Company. At the end of March 1918, the latter succeeded in receiving signals from American stations for the first time by means of frame antennae only .5 square meters in area, the general direction of the sending station being readily ascertained.

In order, however, to warrant reception during seasons of poor sound intensity and at the same time further increase the range of the Braun antenna, the design of frames of larger dimensions was begun, which for reasons later to be discussed, were given the form of squares placed on one of their angles, with sides up to 90 meters in length.

Fig. 1 shows the arrangement of connections of this type of receiver. The energy absorbed in the oscillatory circuit tuned to the receiving wave and comprising a frame (mainly a self-inductance) and an adjustable condenser with movable plates, is supplied to the high-frequency amplifier, which has a double duty to perform. One of these duties is to reinforce the receiving energy in direct proportion to the number of amplifier tubes employed. The other duty is for the last tube, connected up as a detector, to effect rectification of the high-frequency currents, which are then either supplied direct to the telephone or, in case a further amplification proves necessary, have to traverse a low frequency amplifier.

In order further to increase stability and freedom from undesirable effects, the received energy for the high frequency amplifier is not employed immediately from the loop or frame circuit, but conveniently from a secondary circuit loosely coupled with the same in a manner similar to the well known secondary receiver systems.

This arrangement, however, is only used for receiving dampt waves. In the case of undampt reception, a small tube generator (external heterodyne) is required to insure the auxiliary oscillations necessary for best reception, these oscillations being caused to interfere either in the loop circuit or—a most preferable alternative—in the secondary circuit with the incoming wave.

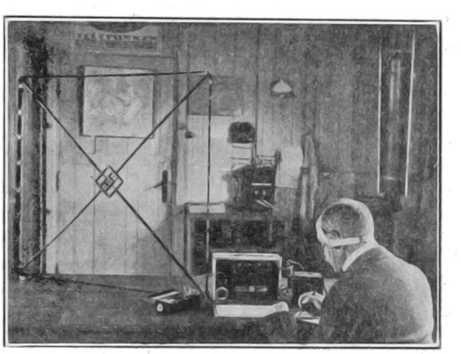
The Braun Frame Antenna is a loop of square section, the side length and number of turns of which should be in proportion to the wave and distance to be bridged. In order to eliminate as far as possible the *influence of the earth* on the loop circuit, the latter is placed on one of its angles at a few meters distance from the ground.

Frames of small dimensions (up to a few meters in diameter) are so arranged as to be free to turn upon a vertical axis, which for mechanical reasons would otherwise become impossible when the loop dimensions exceed a certain limit. These frames may be folded for portable purposes, being readily collapsible. The stand or pedestal and frame proper are arranged to be carried in a special case.

The high frequency amplifier, the most important part of the arrangement, generally comprises four to five high-vacuum tubes connected up in cascade fashion. As may be seen in some of our illustrations, the arrangement will lend itself to a multitude of uses not only indoors, but in the open field and even in so small a craft as a row-boat. Apart from the folding frame, it merely comprises a small case which con-

(*Continued on page* 100)

A German Radio Enthusiast Experimenting With a Loop While in a Row-boat.



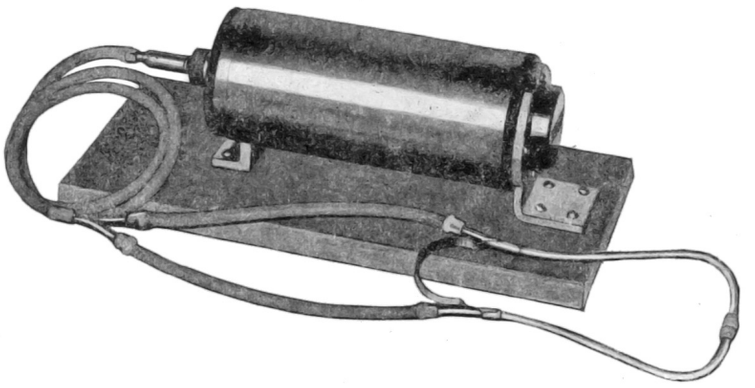
The Braun Loop Antenna Used Indoors for a Multiplicity of Receiving Methods.

* *German Radio Engineer.*

A New Static Eliminator

The Bane of Radio is Reduced by a Method So Simple That One Wonders Why It Was Not Commercialized Years Ago

EDITOR'S NOTE: *While the basic principle involved in the below described instrument is not startlingly new, having been employed by a well known radio company some years ago at its high power transatlantic station, yet it remained for Mr. Lynch to improve and commercialize the idea to its present effectiveness.*



Photograph of the Instrument Destined to Considerably Reduce the Ill Effects of Static. The Principle Employed Is An Acoustic Rather Than An Electrical One.

FOR the past decade, the progress of the art of Radio has been more or less seriously hampered by electrical interference in the atmosphere or in the earth. This interference was observed from the very start of the radio science and today is known under a rather varied list of titles, principal of which are the terms "static", "strays" and "x'es," while the international abbreviation code deals with it as "Q.R.N." No matter what the name or nature given to the interference it has an equal evil effect on the radio receiving circuits of modern apparatus.

Research of the last few years has definitely shown that there are several forms of static and for these science has evolved various forms of electrical circuits with which to combat them.

All manner of systems have been devised and many of them have involved the expenditure of very large sums and many claims have been made for these various systems, theories having been worked out to prove, mathematically, that they will really allow the signal to be heard while casting aside the static.

Some years ago, at the transatlantic receiving station of the Marconi Company at Belmar, N. J., one of the four-hundred-foot towers was used to support a loop receiving circuit of the Bellini-Tosi type and goniometric observations were made of static intensities for several months. It was understood that some of the data was to be used by Mr. Weagant, of the Marconi Company. Whether this data was used by him for the accomplishment of his present scheme for static elimination, which caused quite a sensation in the radio field some few months ago, the writer cannot say, but some of the tests made at that station would lead to the assumption that static was directional at times. These tests were made during the summer months when this sort of interference is generally at its maximum.

PREVIOUS ATTEMPTS.

During, and since the termination of the war, a great deal of experimentation has been carried on with various types of loop receivers and amplifying circuits of various kinds and a great deal has been claimed for them. Instances of these stations being operated and the results obtained may be found in almost every issue of any of the radio papers, but in most cases the description of the results obtained refer to results obtained under favorable conditions, or, at least, not under the worst conditions.

It may also be said that underground radio has likewise been tried and a vast amount of money has been spent in experimenting in that direction. In fact experimentation has not stopt with the use of various types of antennae, but has used all manner of ground devices and counterpoises. Long antennae, short antennae, loop antennae and antennae which would take too long to attempt to describe here have been tried and the same applies to grounds. After the first glamour of wonderful results have been fully described and all agree that the theory of the invention is absolutely right and everyone is beginning to slap everyone else on the back at the thought that our old enemy "Static" has been conquered; one of the trans-ocean receving stations at which the system has been installed calls to the sending station on the other side of the water for some Vs and generally terminates with some such phrase as "Qrn bad here, Qrl."

THE PROBLEM.

If you have not heard what static can do to a radio station, go to some friend's home, any time between May and November, where there is a long wave receiver capable of copying signals from Nauen, Germany, for that is generally the station used for trans-ocean testing. The little peep you hear thru the rattle which sounds like the combined artillery of the Allied Armies going off at once, is probably the long distance station POZ. If you are able to concentrate very strongly on that little peep you will notice that it starts and stops with regular dots and dashes, forming the International Morse Code and if it is clear enough your friend may be able to tell you what it is saying, but the chances are that but a few words will be discernible. That little peep you hear will be the result of the displacing of the ether in Germany by hundreds of horse-power. From that you will have some idea of the problem with which radio scientists have been coping for the past few years. It is quite a task and if you are at all experimentally inclined you will delve into the matter and try to do the job yourself. If you do try, you are choosing one of the hardest problems of the age; one to which the minds which have evolved present day radio have exerted every effort with but comparative success. One of the greatest radio scientist of the age has said that a perfect static eliminator most certainly can be produced, but the fact must be borne in mind that ordinarily when the static is eliminated so is the signal.

If the trans-ocean reception of any of the large stations in this country is followed it will be seen that European stations are compelled to repeat whole messages at times, and at other times static interference is so pronounced as to make attempts at reception quite futile, whereas, under favorable atmospheric conditions the automatic copying and recording of high-speed, trans-ocean signals are possible, it will be noted that when medium static prevails, trans-ocean work is carried on at a speed of about twenty words per minute and words are repeated twice and sometimes three times. When such conditions obtain where the most highly developed static eliminators are being used, it may readily be concluded that the value of such systems is not very great, regardless of the many claims made.

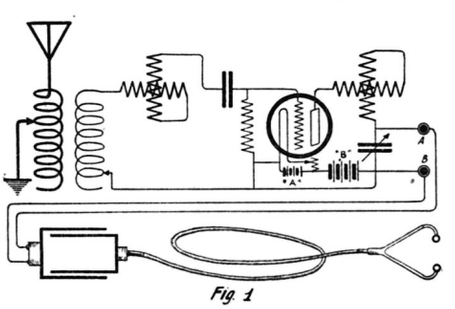


Fig. 1

Ordinary Regenerative Receiving Circuit With the Addition of the Static Filter.

A SUCCESSFUL METHOD.

With this brief review we come to present day development. Everyone will admit that modern radio is ready for the entry of a truly effective static eliminator. With the previously mentioned facts in mind we therefore place before the readers of RADIO NEWS a brief description of an instrument which let us hope has at last struck the happy principle toward the efficient elimination of static.

Mr. Arthur H. Lynch of New York has recently applied for a patent on an instrument which he has given the rather characteristic name of NOSTAT. An illustration of the general appearance of the device may be seen by studying the accompanying photograph. It consists of two perfect cylindrical brass forms, the diameter of one being slightly smaller so as to allow it to fit the other snugly, and in such a manner that the internal sound chamber may be readily varied at will. To the right may be seen the outside casing of a Baldwin supersensitive telephone receiver, the diaphragm of this receiver forming the wall of one side of the chamber. To the left of the instrument is seen the protruding tube of the stethescope arrangement to which is attached a long flexible tube leading to the ear pieces.

METHOD OF OPERATION.

Static, as is well known, being inherently of the same nature as radio signals, it is almost impossible to reduce one without seriously decreasing the intensity of the other. In fact, it usually is a one-sided proposition. That is to say, when one tunes out static the signals decrease correspondingly, but it is not always the case that static diminishes when the signal strength is decreased.

In the case of the present device, however, it is based on a rather different principle than the one ordinarily met with in

(*Continued on page* 98)

Japanese Radio Apparatus

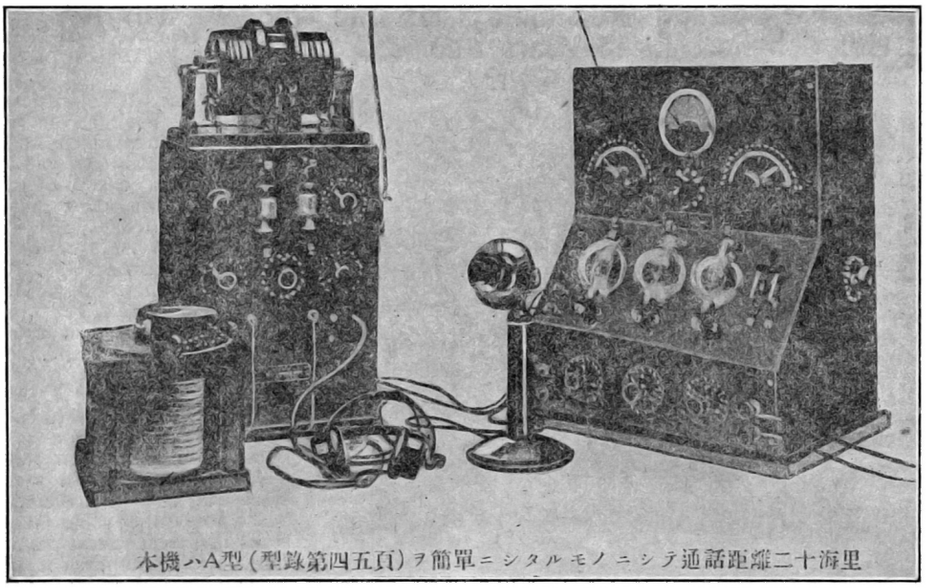
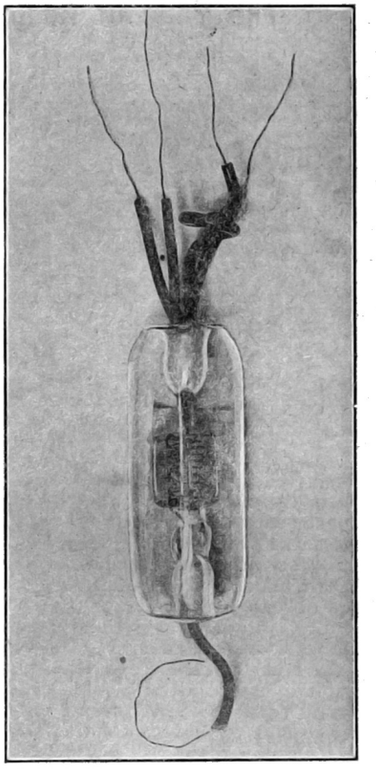


Fig. 2. Radiophone Transmitter Is Shown to the Right While the Receiver Is at the Left of Photograph. Set Is Capable of Covering 20 Miles on the Open Sea. To the Right Is Shown Fig. 1, Which Is the Japanese Version of the Audiotron. Two Types Are Manufactured; One Being Practically the Same as the American Audiotron. In the Present Case the Interesting Feature Is the Fine Glass Structure Which Is Designed to Support the Plate, Which in This Instance Consists of Many Turns of Very Fine Wire Wound Upon a Square Glass Frame.



THE Japanese have at last entered the radio manufacturing field with an almost revengeful earnestness. Here are several examples of their workmanship. Fig. 1 shows a close-up of a vacuum tube that is now being manufactured in Japan, which suspiciously resembles the far-famed audiotron. As a matter of fact, two models of this bulb are being manufactured, one of which is shown here on account of its original grid construction and the other which is practically the same as the audiotron. In the present one note well the fine glass structure designed to support the plate. In this case the plate consists of *many turns of very fine wire* upon a square glass frame, as may be seen in the photograph.

In Fig. 2 we have a radiophone set known as the Type B. This instrument has been specially designed by the manufacturers for ship work, where they claim a working range of twenty nautical miles on open sea. In the illustration the receiving set is shown to the left, while the transmitter may be seen to the right.

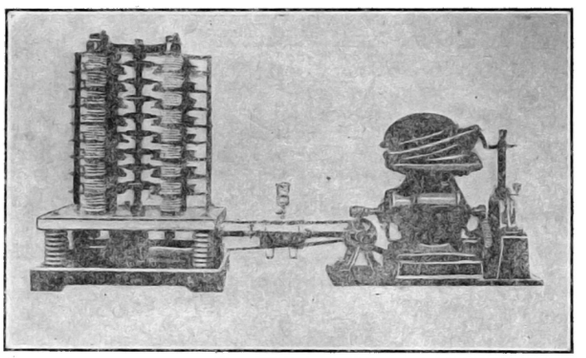


Fig. 3. Above Is a Quenched Gap Suitable for 3 K.W.

Fig. 3 shows a quench spark gap of a somewhat unique design and which will effectively handle 3 KW. On the right side of this photograph may be seen the motor which primarily revolves the gap units and in addition has a worm gear arrangement operating a set of bellows for the purpose of cooling the gap. This is a rather different way of getting around the usual electric fan cooling system with which we are familiar in this country.

There is no guess-work in the manner in which the Japanese prepare their young men for this important branch of engineering. Interested prospective radio enthusiasts are given several years of technical education designed to make them future specialists. For this reason we may expect some very interesting developments from our contemporary Far East radio engineers who have long realized the great commercial value of radio telegraphy and telephony.

Important Radio Examination Notice

DEPARTMENT OF COMMERCE,
NAVIGATION SERVICE
Office of Radio Inspector Custom House,
New York, N. Y.

Editor Radio News,
New York.
Sir:

After July 1st, 1920, applicants examined in this office for commercial radio operator's licenses will be tested in their transmitting ability in sending Continental Code.

Applicants for Commercial First Grade Operator's licenses will be required to send 100 satisfactory code characters in succession in a five minute test at a 20 word per minute speed.

Applicants for Commercial Second Grade Operator's license will be required to send 60 satisfactory code characters in succession in a five minute test at 12 words per minute speed.

The transmissions by the applicant will be received by the examiner and will also be graphically recorded on a tape recorder as a check against transmissions in case of doubt.

Radio schools training men who expect to take these examinations are requested to prepare their students for this transmitting test and include a test therein before they give the student the usual letter certifying that they have satisfactorily passed the course, and for which the applicant is allowed a 10% experience mark in this office. The transmitting test given the applicants will include characters, numbers and signals of all kinds used in the usual transmission. The conditions under which the applicant is tested are made as nearly similar to actual conditions as possible, the applicant hearing his own note in his receivers and otherwise working under no unusual conditions.

After July 1st, examinations for Commercial operator's licenses will be given on MONDAYS, WEDNESDAYS and FRIDAYS only, except on holidays. The examination is given at 9 A.M. in this office, Room 603, Custom House, and applicants should appear promptly with whatever documentary evidence they may have indicating their radio experience and training. Reservations for places should be made in advance as the facilities are limited and it is expected will be completely utilized on each day.

Respectfully,
L. R. KRUMM,
Chief Radio Inspector.

June 29, 1920.

French Vacuum Tube Instruments

By J. GOUSSIN*

I AM delighted to be able to present to the readers of RADIO NEWS a few examples of French amplification apparatus. These instruments may, perhaps, suggest some interesting comparisons.

Fig. 1 shows a three-stage amplifier suitable for low-frequency work. This model has great amplifying qualities, the stages being coupled by means of iron core transformers. The same model is also constructed having one stage of radio frequency, galena and crystal detector, and two stages of low, or audio-frequency, amplification. However, in this later model the amplification is slightly less than that of the above-mentioned instrument, altho the resonant properties are better and, therefore, reception is improved. There is also a four vacuum tube model which contains

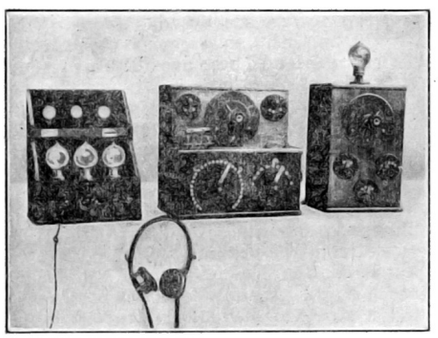


Fig. 2. Three Complete Receiving Units; a Three-Stage Amplifier, the Tuner and the Heterodyne Set.

a stage of radio-frequency amplification, galena detector, and three stages at audio frequencies. This model attains the highest degree of sensitiveness.

Fig. 2 is a photograph of three complete receiving units; that is, one box containing the necessary inductances, condensers and crystal detector, another box containing the three-stage amplifier and, finally, the heterodyne set for the reception of both dampt and undampt waves. The primary and secondary coils of the reception box are wound in such a manner that there are two layers wound over each other simultaneously, which permits of compactness and reduces space area. This box is but

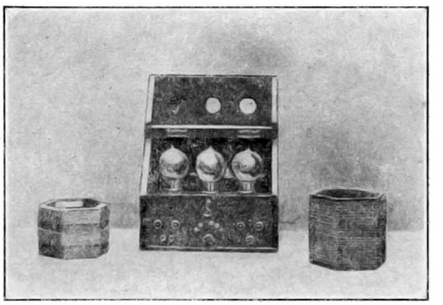


Fig. 1. Three-Stage Amplifier Suitable for Low Frequency Work.

30 centimeters in length, the two coils being placed lengthwise and in such a manner that their mutual relation may be sufficiently varied to permit of proper coupling.

Despite these small dimensions it is possible to receive wavelengths up to 12,000 meters. Both the primary and secondary are arranged with automatic dead-end cutouts.

The variable condenser is of the air type, and in addition to this there are extra fixed condensers which may be added to the antenna circuit or to the secondary circuit. Two of the binding posts shown are for the purpose of connection to a detector, while the other two binding posts are for the radio-frequency amplifier, in which case the detector is connected to the amplifier. The heterodyne consists equally of a two-layer inductance, which also considerably reduces the dimensions of the coil, which is 12 centimeters in length and 12 centimeters in diameter for wavelength up to 20,000 meters. All conducting parts of this apparatus are mounted upon ebonite, thereby insuring perfect insulation.

Fig. 3 shows the illustration of a small type vacuum tube transmitter, consisting of two bulbs from which may be obtained an antenna current of one ampere. The same apparatus serves for heterodying in reception. Incidentally, it may also be used for radio telephony by including a microfone transmitter.

To the left of this photograph is shown the transmission inductances used with the four-bulb set, and also consists of two windings, or layers, one on top of each other. This inductance is practically the same as that employed in the smaller two-bulb transmitters. This system of winding, which is in reality that of the so-called "bank" form, was first employed by myself before 1914. Its great advantage is that it permits considerable reduction in the size of the inductance, a desirable factor in portable as well as stationary sets. Additional layers may, of course, be banked in this manner, thus further securing compactness; however, if this is done, well-known undesirable effects will result, owing to multiple resonance, so that reception becomes more difficult. I hope this brief description will be of sufficient information and value to American readers. The instruments described, of course, were built by myself.

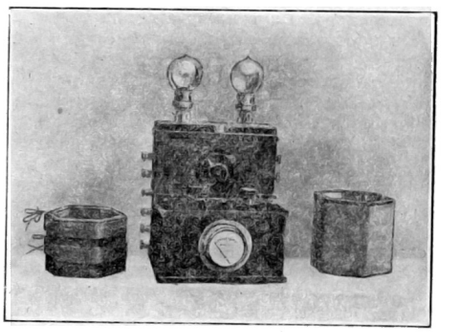


Fig. 3. Small Type V. T. Transmitter Furnishing Antenna Current of One Ampere.

FRENCH V. T. APPARATUS NOTICE.

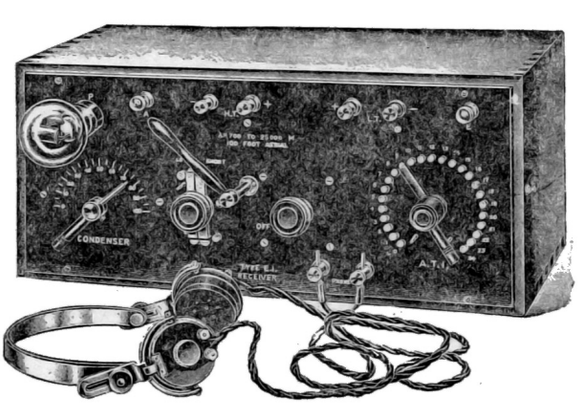
Concerning the article entitled "French Application of the Momentous Vacuum Tube," by Captaine Metz, which appeared in the May and June issues of RADIO AMATEUR NEWS, we have just received word from the *Société Indépendente de Télégraphie sans Fil*, Paris, France, that the resistance-coupled amplifiers mentioned therein were originally invented by Messrs. Brillouin and Beauvais, formerly officers of the French Signal Corps. This same company also informs us that they hold world-wide patents for these instruments and that they have taken the place of "amplifiers with step-up transformers."—*The Editors.*

* *French Electrical and Radio Engineer.*

The Latest Word in British Receiver Sets*

The accompanying illustration is that of an instrument just placed on the market by a London concern who incidentally inform us that it is a veritable masterpiece.

This receiving set will readily respond to signals from any wavelength between 700 and 20,000 meters when used in conjunction with a standard 100-foot aerial. An experimenter in London has read with considerable clearness the time signals from POZ and FL, as well as copied press items from PSO and many of the continental stations having both long and short wavelengths by simply using a small loop antenna which happened to be almost entirely screened by surrounding metallic conductors. However, by substituting the previously mentioned standard aerial, time signals, press and weather reports of NAA and other American stations



An Example of British Receiver Workmanship. The Set Is Capable of Reception Work Ranging from 700 to 20,000 Meters, Either Dampt or Undampt Signals.

have been easily and frequently copied.

To operate the set all that is necessary is to connect the necessary batteries to binding posts marked LT and HT, as well as phones, aerial and ground, adjust the filament regulator and all is ready for the tuning in of any particular station. After rough adjustment on aerial tuning inductance, sharp tuning is accomplisht on the variable condenser. A slight adjustment of the "reactance" coil will bring in the signals quite clearly and sharply whether they be CW or spark. Radiophone speech of course may also be received with the set.

As will be seen a single vacuum tube is mounted on the panel which is readily controlled by the filament regulator. This vacuum tube is of the standard British make, having its elements placed sidewise within the tube instead of up and down as is the case with American tubes.

* *Illustration by courtesy of Mitchell's, London.*

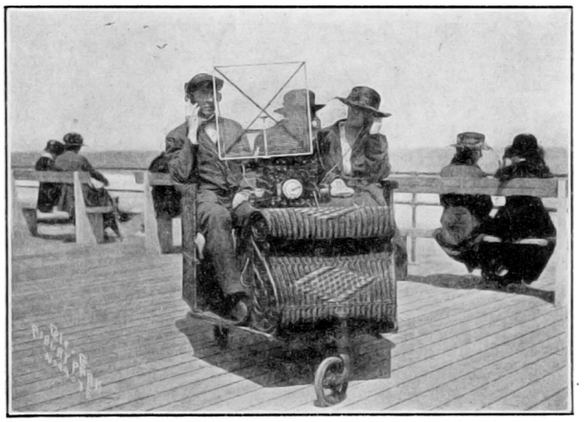
The Radiophone on Roller Chairs

A New and Interesting Use of the Loop

VISITORS to Asbury Park, N. J., this season are being entertained with a most unique innovation introduced by W. Harold Warren in the form of a roller chair equipt to receive wireless telephone and telegraph signals as the passenger rolls merrily along the boardwalk.

Scores of boardwalk promenaders are attracted by the various demonstrations and are permitted to "listen-in." They hear the conversations and musical phonograph records which are transmitted by the Foxhurst station of the Deal Beach plant of the Western Electric Co. With this compact loop Mr. Warren has heard messages from stations as far south as Norfolk, Va., and as far north as New Haven, Conn. A recent test showed the received signals to be as distinct as tho a regular antenna had been used, allowing of course the reception of signals from stations of equal distances. The accompanying illustration is a photograph taken on the boardwalk of Asbury Park and shows Mr. Warren and his sisters, Misses Warren in the act of making tests preparatory to evening demonstrations. All of the equipment used is shown in the photograph except a set of A and B batteries which are located below the dashboard of the roller chair.

The apparatus is so compact that three persons can sit comfortably with it in the chair. It consists of a "loop," an audion detector, and an amplifier.



By Means of a Radiophone Set Installed on a Roller Chair, Summer Visitors to Asbury Park May Now Enjoy Concerts While They Traverse the Boardwalk's Length. The Chair Occupants Are Listening to a Phonographic Concert Many Miles Away.

The "loop" is of the flat type and measures eighteen inches on each side. The cross supports and protecting frame are made of white pine lattice ¼ inch thick by 1¼ or 1½ inches wide. Each of the cross supports is 25½ inches long. A notch is cut in each support at the center and then joined so as to form an "X". Commencing 3½ inches from the center, saw cuts ½ inch apart are made on both edges on each of the four legs. Beginning at the first or inner saw cut No. 26 S. C. C. wire is wound tightly in a clockwise direction to the outer edge. The loop is then turned around, the wire crossed over the leg, and the winding continued in an anti-clockwise direction on this side, back to the first saw cut. Two single Fahnestock connectors are then fastened to two of the legs—one connector on each—near the center. A cross strip is placed between the other two legs in the center of which a hole is bored about half way thru the strip. A hole of the same size is also bored in the center of the bottom protecting strip. A ⅜-inch dowel rod is inserted in the lower hole past upward between the windings to the cross strip. This allows the loop to be revolved. A set screw is inserted in the lower protecting strip to keep loop rigid in one direction, if desired. No coils are used, tuning being accomplisht solely with the variable condenser. There are 18 turns on each side of the loop and approximately 90 feet of wire is used. This size of loop is most effective for wavelengths from 300 to 500 meters but good results have been obtained on wavelengths up to 800 meters. Excellent results have been experienced with the apparatus in a moving auto and in buildings of all kinds of construction. As the radiophone stations of the Western Electric Co. at New York City and Deal Beach, N. J., are now operating on wavelengths close to 400 meters, this loop has proven most effective.

The Radio Girl

By A. MAE ROGERS

Editor's Note: Miss Rogers, who is the sister of the well known scientist, Dr. James H. Rogers, of Hyattsville, Md., who has done so much research along the line of underground systems, was recently so imprest by an editorial concerning standardization of radio apparatus that she decided to make use of the idea in what would constitute to be a woman's interpretation of the subject as applied to her apparel. The result is shown by a replica of the original water color shown on this page. Unfortunately the coloring and rather elaborate, vivid representation cannot be reproduced to full advantage.

My radio girl is fully equipt with most of the necessary paraphernalia for "list'ning in," receiving or sending. She has taken her grandmother's hoop skirt for inductance, and a lovely parasol for an umbrella antenna. Bright jewels replaced with sparkling DeForest audions adorn her person, and now that Dame Fashion has decreed that every woman shall cover her ears with "pops," the receiving phone may be placed either above or concealed beneath this portion of her artistic coiffure. Sometimes she uses a fan for transmitting the voice or a key thereon for Morse. Eveready batteries ingeniously placed in the bottom of her skirt almost complete this wonderful costume, but the most important thing now needed is to *standardize* the above outfit so the ladies may become attuned to perfect harmony—something never before known or accomplisht! I think the fair sex thus equipt will be a great incentive to other members of the Radio Sisters to come forward and by combining efforts and suggestions they will greatly encourage and assist themselves and the radio amateur boys in the development of radio communication under or above ground, as well as far beneath the sea. We sincerely hope soon to solve the mystery of standardization as suggested by Mr. Gernsback in a recent number of *Radio Amateur News*. Our radio girl will then be almost a perfect woman.

Miss Rogers Tells Us the Wireless Girl Has Come to Stay and to Prove It Presents Us With This Symbolic Portrait of the Girl in Question.

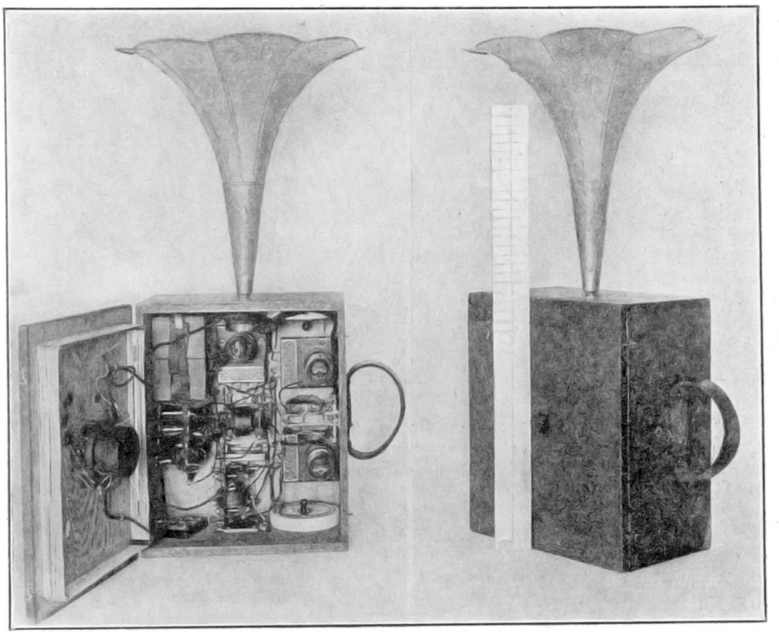
Music Wherever You Go

Government Experts Develop a Portable Radiophone

HERE is the last word embodied in the portable receiving set idea. This highly efficient instrument has been developt in the radio section of the Bureau of Standards at Washington and altho the experts of this Bureau modestly referred to it as being in the experimental stage, it is probable that this type of instrument is destined to become widely used on account of its practical and portable nature.

The present *portaphone* has one stage of radio amplification and two stages of audio amplification; one tube being used both as a radio and audio amplification stage.

By referring to the left hand illustration of the above photograph, which shows the internal construction of the set, may be seen the loop which is wound upon the four sides of the cover. Directly in the center of this cover is the tuning condenser for wave-length variation. The instrument, by the way, was designed to receive waves of 500 meters. The vacuum tubes are of a special design requiring but 0.2 ampere to operate the filament. It will also be noted that both the A and B batteries are conveniently arranged within the case, they being as small and compact as possible in order to secure minimum weight for the entire unit. It will be seen that the amplifying transformers are at right angles to each other in order to eliminate all possible mutual effects between individual circuits.



The Portaphone Permits of Music Being Heard Anywhere Within a Large City and of Sufficient Intensity to Be Heard Clearly Within an Ordinary Room.

When the radio telephone station of the Bureau of Standards at Washington is in operation with an antenna current of 2 amperes while transmitting, music and speech may be readily picked up by a person situated within the city limits by using the *portaphone.*

The instrument itself without the horn is 12″ high and 10″ wide. This gives an idea of its compactness and portable nature. The horn, of course, may be strapt to the case and carried along as well. A desirable feature connected with the instrument is that it is very simple of operation and does not require an expert electrician or radio man to set it in operation. This fact alone opens up considerable future possibilities in the commercial field. Incidentally, it would be an ideal set for the more advanced amateur to take along with him on his vacation, be it far into the mountains or at the seashore. He thus can keep in touch with the news, weather reports, radiophone conversations, radiophone music, and any other information transmitted by radio.

The approximate range of the instrument in its present development is about 20 miles, but of course this can be considerably increased by making use of a regular antenna. An instrument similar to this one has been built at the radio section of the Bureau of Standards which is sufficiently powerful as a transmitter to reproduce phonograph or other music with enough intensity so as to be heard within a room of considerable size and which, by the way, would be an excellent arrangement for dancing.

A more sensitive type of *portaphone* is now under construction by the Government experts. It will contain three radio and two audio stages of amplification and will be so arranged that the horn and all other instruments are self-contained within the box. With this device music may be heard within the limits of any large city.

Concerning Radio Development

A SHORT time ago a contemporary technical magazine printed the announcement that a certain well-known financial expert had launched forth the *almost* convincing statement that "In a year or so all phases of radio will have been so exhaustibly treated that there will be nothing more to write about."

What childlike simplicity! Our financial experts had better leave the matter of scientific prophesies to persons a little more closely associated with any given matter, whether it be radio or ice-making. A medical doctor would hardly go to the shoemaker for expert advice on neurasthenia.

Then, also, such a statement naturally precludes that when all phases of radio have been so completely expounded, we shall have reached the zenith of radio apparatus development as well.

This same magazine, naturally enough, went on to say that, although this great man spoke with conviction, past and present developments do not seem to indicate any such dire condition.

Our contemporary writer might have gone on and given a few more solid reasons why this will not take place. For instance, the same thing might justly have been said concerning the telephone, which, unlike radio, does not offer the many possibilities and varied fields of exploitation that the Hertzien Science offers. The telephone covers simply one condition: that of transmitting speech from one point to another by wire. In this case we have seen where the human voice has bridged the short distance of a few miles to the present one of several thousand miles—and the end is not in sight.

With this limited field of endeavor, would one say that the end of telephone development has been reached, and that today there remains nothing to be written about the telephone? This is hardly the place to mention the number of periodicals which specialize in telephone and allied subjects, exclusive, of course, of the many general magazines and books which give a certain amount of space to the telephone.

With this in view, consider now radio. Not only does it take in radio telegraphy and telephony as well, but it takes in many kindred possibilities, both of the present and of the future. Take, for instance, telemechanics, radio dynamics or radiokinetics, or whatever you wish to call it—that branch of radio which makes possible the operation and control of distant objects and devices by means of radio control; in other words, actuating instruments entirely without visible means. In this connection, by the way, the French and English have done remarkable work of recent years, particularly during the war.

Have no fear, when we have reached the top notch of radio telegraphy and telephony (a condition which, it is safe to say, will never be reached in our time), there will remain and probably will be discovered many additional effective labor-saving devices designed to relieve, or, at least, somewhat alleviate, the burden of mankind. *And radio will most certainly take an active part in these desirable things, whether it be safety devices at sea, on land and in the air.—P. H. B.*

Design of a Radio Receiving Set

Part II

By L. M. CLEMENT

WHAT WILL BE THE BEST MATERIAL TO WIND YOUR COIL ON?

MICARTA or Bakelite tubing with ⅛ in. or 1/16 in. walls are probably the best materials to use for the cores of inductance coils altho cardboard tubing is satisfactory.

The question of providing means of adjusting the coupling between the primary and secondary of an oscillation transformer is pertinent at this time and the following schemes have been suggested.

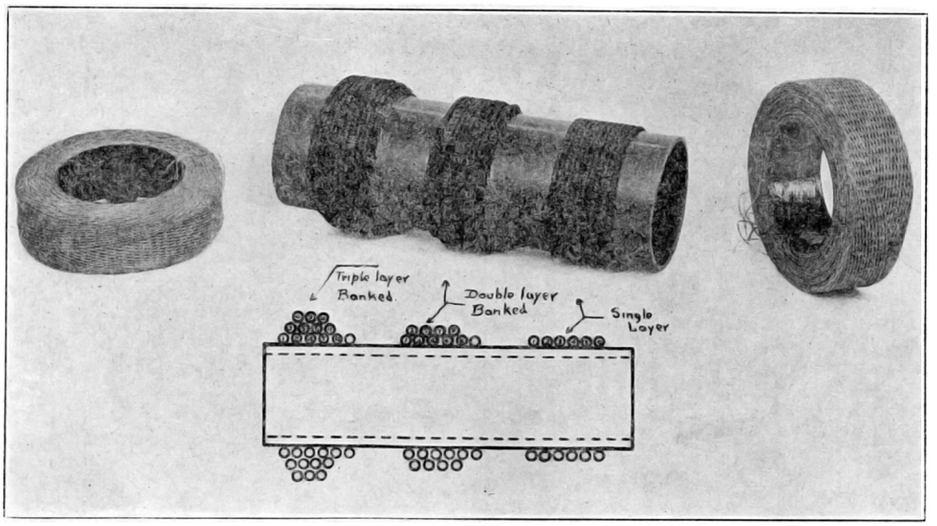


Fig. 6. The Center Illustrations Show Three Forms of Windings, Single-Layer, Double-Layer and Triple-Layer. To the Right and Left Are Shown Two Forms of Lattice-Wound Coils; the "Honeycomb" and the "Duo-Lateral."

The primary coil may be moved along its axis away from the secondary coil as shown in Fig. 12a or perpendicular to the axis as shown in Fig. 12b. In the second case the coils need only move a distance equal to the diameter of the coil to pass thru a point of zero coupling.

DEAD ENDS IN COILS PRODUCE LOSSES WHICH RESULT IN POOR TUNING. HOW CAN THIS BE PREVENTED?

This can be prevented by choosing coils of just the proper inductance value to give the desired wave length without taps. If it is desired to cover a range of wave lengths several coils should be chosen each one of which would be capable of covering a portion of this range. The *Duo Lateral Coil* is very convenient in this respect and can be purchased in a number of convenient sizes.

HOW WOULD YOU CONSTRUCT A DEAD END SWITCH FOR YOUR LOADING COIL?

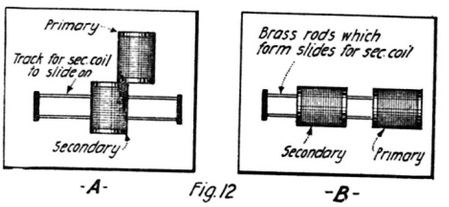
The same result is obtained in single layer or banked wound coils by the use of dead end switches which break the coil up into a number of small sections. This can be simply accomplisht in a number of ways. These methods making use of single pole double throw switches, a plug system and a special switch as illustrated in Fig. 13.

In some cases where dead end switches are not used it is found impossible to receive some wavelengths due to the *resonance of the coil system to some wavelength near the desired one.*

AN EXAMPLE YOU CAN FOLLOW

Possibly the best way to describe the design of a receiver will be to assume a set of given conditions and work out the design of a set to meet these conditions.

Suppose you want to be able to receive signals from ship stations in 600 meters and also the Arlington time signals on 2500 meters. From this information our receiver should have a range of wave lengths from 400-3000 meters.



Two of the Several Methods of Varying Primary and Secondary Inductive Coupling.

Let us assume that two variable condensers of 1500 M.M.fds. maximum capacity and 80 M.M.fds. minimum capacity are available and that it will be possible to put up an antenna 20 ft. high and about 200 ft. long.

From Table I we can determine approximately the electrical constants of an antenna which it is possible to construct at our receiving station. Suppose the antenna of the inverted "L" type 20 ft. high and 200 ft. long is available. Its natural wave length is 275 meters and its capacity is 450 M.M.fds.

The given constants may be summed up as follows:—

Antenna capacity 450 M.M.fds.
Tuning condenser 80-150 M.M.fds.
Wave length range 400-300 meters.

THE DETERMINATION OF THE SECONDARY CIRCUIT.

Since the leads to the audion, the capacity of the grid-filament circuit of the audion and the distributed capacity of the coil are connected across the tuning condenser, we will add to the minimum capacity of the condenser a constant to take care of this effect. This constant will be about 60 M.M.fds. Adding this to the minimum value of capacity of the secondary condenser the effective capacity range becomes 140-1500 M.M.fds.

A family of curves showing the wave length obtained with a given inductance and value of condenser capacity is shown in Fig. 7. For this particular case it is desired to find the value of inductance which, when shunted by a capacity of 140 M.M.fds., will give a wave length of 400 meters. Following the 140 M.M.fds. line across we find that it intersects the .3 M. H. curve near 400 meters. The maximum wave obtainable with this value of inductance is found to be 1260 meters by following the 1500 meter line until intersection with the .3 M. H. occurs.

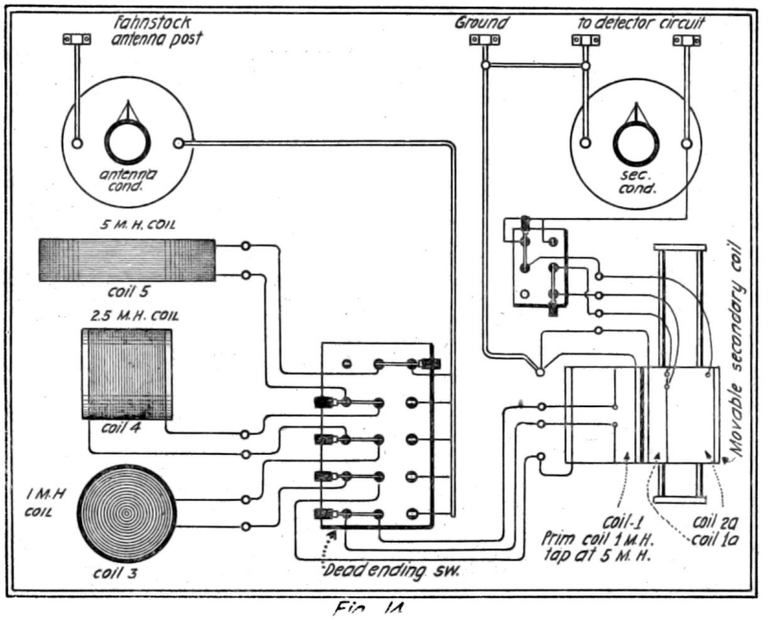


Fig. 14

General Scheme of the Layout and Wiring Connections for the Receiving Set Described in the Text of This Article by Mr. Clement.

HOW MUCH OVERLAP SHOULD WE ALLOW FOR OUR RECEIVER?

Allowing an overlap of 20% of 250 meters we can proceed to find the inductance which will give 1040 meters at 140 M.M.fds. capacity. This is found to be 2 M. H. but the maximum wave obtainable is about 4500 meters which is above

TABLE III

Table Giving the Effective Value of Capacity of an Antenna and Series Condenser

Capacity of the Series Condenser in M. Mfds	Capacity of Various Antenna Systems											
	100	150	200	300	400	500	600	700	800	1000	1250	1500
25	20	21.5	22.2	23	23.5	23.6	23.6	24	24.2	24.4		
50	33	37.5	40	42.9	44.5	45.5	46.2	46.7	47.2	47.7	48	48.5
75	42	50	54.5	60	63	65	67	68	68.5	69.7	71	71.5
100	50	60	66	75	80	83	85	87.5	88.8	91	93	94
150	60	75	86	100	109	115	120	124	126	130	134	136
200	66	85	100	120	133	142	150	155	160	166	173	176
300	75	100	120	150	171	187	200	210	218	230	242	250
400	80	109	133	171	200	222	240	254	266	285	302	316
500	83	115	142	187	222	250	272	291	308	333	356	375
600	85	120	150	200	240	272	300	323	343	400	405	429
700	87.5	124	155	210	254	291	323	350	373	412	450	460
800	88.8	126	160	218	266	308	343	373	400	445	487	522
900	90	128.5	163	224	278	320	360	394	424	473	524	563
1000	90.5	130	166	230	285	333	400	412	445	500	550	600
1250	93	134	172	242	302	357	405	450	487	550	625	682
1500	94	136	176	250	316	375	429	480	522	600	682	750
2000	95	139	181	260	334	400	462	519	571	666	769	859
2500	96	142	185	268	344	416	484	547	607	714	832	937
3000	97	143	187	272	354	429	500	567	634	750	882	1000
4000	97.5	144	190	276	364	445	522	597	668	800	951	1090
5000	98	145	192	283	370	455	535	639	690	833	1006	1150

the upper limit desired. By choosing 1.5 instead of 2 M. H. a smaller coil results and the wave length range becomes about 740-3350 meters.

Thus it is seen that a 1.5 M. H. coil with a tap at .3 M. H. or a .3 M. H. and 1.2 M. H. coil will be satisfactory for the secondary circuit of the receiver.

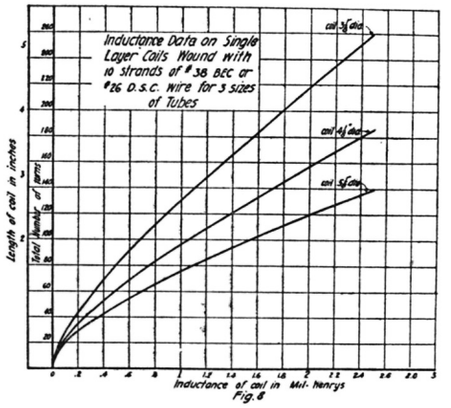
PRIMARY CIRCUITS.

The primary circuit consists of the antenna in series with the primary condenser and the loading and coupling inductances. In order to be able to calculate the wave length of the circuit, or the inductances required, we must first determine the effective capacity of the antenna and antenna condenser at the maximum and minimum condenser setting.

HOW DO WE FIND THE VALUE OF TWO CONDENSERS IN SERIES?

Table III is so constructed that this effective capacity is easily found. In our case the antenna capacity is 450 M.M.fds. and it is desired to find the effective capacity of 100 in series with 450. From the table, 100 in series with 400 is 80 and 100 in series with 500 is 83, so that 100 in series with 450 is about 82. In the same way 1500 in series with 450 is found to be 340 M.M.fds. The effective capacity of the antenna system is varied from 82 to 340 M.M.fds.

Referring to Fig. 7 and following the 82 M.M.fds. line until it intersects a curve near 400 meters, it is found that .5 m. h. is needed. The maximum wave for 340 m. mfds. is 700 meters.


Inductance Data on Single Layer Coils Wound with 10 strands of #38 BEC or #26 D.S.C. wire for 3 sizes of Tubes
Length of coil in inches
Total thousands of turns
Inductance of coil in Mil- henrys
Fig. 8

Inductance Data On Single Layer Coils for Three Sizes of Tubes.

Allowing a 20% overlap which amounts to 140 meters in this case, it is now necessary to determine the inductance which, when shunted by 82 m. mfds., will be resonant to waves of 560 meters length. (700-140).

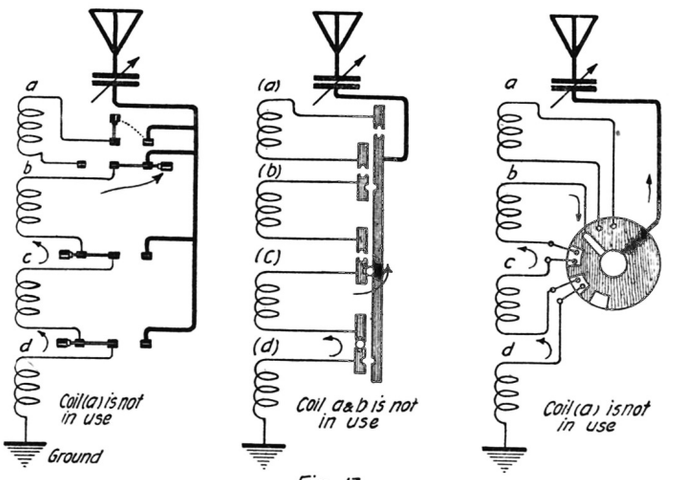
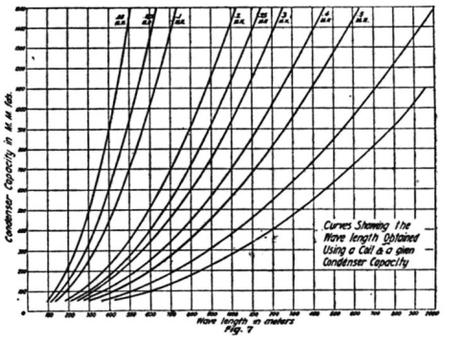


Fig. 13

Three Practical Methods of Dead-Ending Coils, First by Means of Small Knife Switches, Second by Means of Plugs, Third by Means of a Circular Switch.



Family of Curves, Showing the Wave Length Obtained With a Given Inductance and Capacity.

Refer to Fig. 7 and follow the 82 m. mfd. line until it intersects the inductance curve nearest 560 meters. It is found that a total of 1 m. h. will be needed for this second wave length tap of the primary inductance. The maximum wave length for this inductance is found in the same way and is 1100 meters.

In the same way it is found that 2 m. h. will give a wave length range of from 800 to 1500 meters, 4.5 m. h. a range of from 1100-2200 meters and 9.5 m. h. a range of from 1700-3250 m. h.

In the last case a 10 m. h. inductance would give sufficient overlap, but its maximum wave length would be 4500 meters. More overlap is allowed at this point so that the total inductance may be reduced and still meet the maximum wave length requirement of 3000 meters.

The electrical constants of the receiver just determined can be tabulated as shown in Table IV.

HOW WOULD YOU USE HONEY-COMB OR DUO-LATERAL COILS IN A RECEIVER?

A very satisfactory type of receiver can be constructed by using just the right value of inductance or series of inductances to

(*Continued on page* 110)

TABLE IV

Table Showing Electrical Constants Determined for the Receiving Set

Coil Number	Capacity range of variable condenser C in M. Mfds.		Variation of the effective capacity of the antenna circuit in M. Mfds.		Total Inductance loading in antenna circuit in M.H.	Added Inductance in M.H. (L-L)	Wave length range of the circuit in meters	
1.	100	1500	82	340	.5		400	700
2.	100	1500	82	340	1.0	.5	560	1100
3.	100	1500	82	340	2.0	1.0	880	1500
4.	100	1500	82	340	4.5	3.5	1200	2250
5.	100	1500	82	340	9.5	5.0	1700	3250

Secondary Circuit

			Effective variation of capacity of the secondary condenser, taking into account the tube and leads					
1a.	80	1500	140	1500	.3		400	1260
2a.	80	1500	140	1500	1.0	.7	740	3250

Mechanical Data

Coils wound with 10 strands of No. 38 B. E. C.

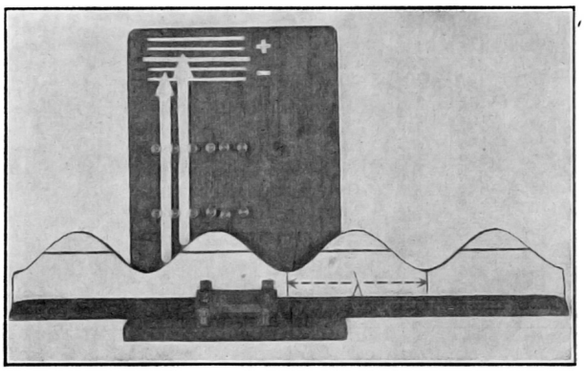
Coil No.	Inductance		Diameter of Coil	Length	Type of Winding	Total Turns	Tap Turns
1.	.5	1 mh.	4⅛"	1.85"	Single Layer	94	....
2.	.5						
3.	1.0		4⅛"	1.85"	Single Layer	94	....
4.	2.5		4⅛"	1.37"	Double Layer Banked	137	....
5.	5.0		6⅛"	1.54"	Double Layer Banked	154	....
1a.	.3	1 mh.	4⅛"	1.85"	Single Layer	94	
2a.	.7						

Unique Electric Wave Model

By R. C. CLINKER*

HERE is an interesting device of a type seldom seen in this country. It is employed in England to demonstrate in strikingly graphic manner just what takes place in a loop receiver during the reception of Hertzian waves. As a well-known educator recently wrote us, graphic illustrations, altho older than script, remain the most direct and easily understandable method of description.—The Editor.

The movable wood strip with sinuous edge is intended to represent the waves of magnetic lines of force, which, traveling horizontally, cut in succession the two vertical sides of a rectangular receiving loop. The wave length is, here, 5 inches, and the black line running lengthwise is at the zero of magnetic force. The two vertical arrows, which slide between rollers, represent the positions of the two sides of the coil, and their vertical motion represent the amplitudes and the phases of the EMF's induced in the two sides. The resultant EMF in one turn of the coil is, therefore, represented in magnitude, and phase by the line joining the two arrow tips. It will be seen that the width of the coil in the model is of necessity greatly exaggerated, over that in the practical case, as it is about one-tenth the wavelength. Nevertheless the useful EMF (viz., the line joining the arrow heads) is seen to be small compared to the EMF induced in each side. In the practical case it is far smaller as the coil is usually far shorter compared to the wavelength. Placing the right-hand arrow one position to the R.H. gives us a coil of length equal to quarter of a wave and a phase displacement of 90° between the EMF's. Moving again to another position gives a coil of a half wavelength, and only now is the full sum of the EMF's available to act on the receiver.



The Sine Wave Moves Along a Grooved Track Causing the Two Arrows to Move Up and Down According to the Amplitude of the Wave.

In the practical case the induced EMF's are nearly, but not quite in opposition, as regards useful result. It is only the "not quite" which allows us to hear the signal. In other words, we are, in using a loop receiver 4 feet long, dependent for our signal on the minute interval of time taken for the ether wave, traveling at 186,000 miles per second, to cover a distance of 4 feet.

Placing both arrows in position 1, i.e., turning the coil so that its plane lies across the line of advance of the wave, gives complete opposition of the EMF's and no signal. However, the full value of EMF is still induced in the sides of the coil.

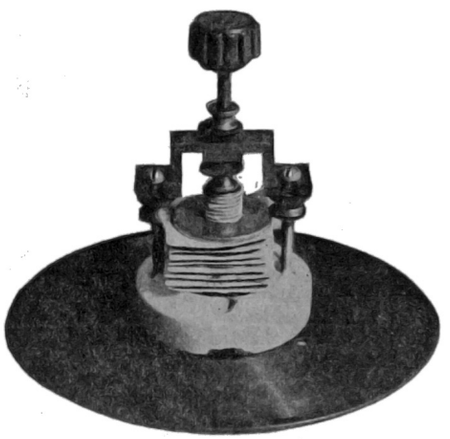
** Transformer Engineer, The British Thomson Houston Co., Ltd.*

A Telescopic Quenched Spark Gap

The quenched spark gap when properly constructed and operated is a very efficient instrument, but there are many of these devices in use to-day which are of old design, being hard to adjust rapidly, which do not give the high grade of service which is naturally expected from them.

A new type of telescoping spark gap of the quenched type is shown in the accompanying picture, which is very easily made and can be adjusted through a wide range of power requirements, without changing any clips, simply by turning the hard rubber or composition handle fitted to the small electrodes.

Reference to the photograph will disclose the fact that the gap in question is made up of two separate sets of electrodes of different sizes, the smaller of which can be contained within the larger which are made in the form of annular rings.



With This Simple Quench Gap Proper Adjustment Is Easily Made by Turning the Composition Knob.

The small electrodes can be made from any desired number and size brass disks, half a dozen one-half inch circular disks being suitable for powers up to ½ K.W. These are separated by mica washers with ¼ inch center holes, the complete pile of disks and washers being held together by shellac, after the end disk has been fitted to the threaded shaft. These disks should have rounded edges to prevent sparking over the washers on the outside, and at the same time permit contact to be made with the inner edges of the annular rings which form the large electrodes; also with rounded edges.

Large mica or paper washers can be made to separate the metal washers which form the annular electrodes of the gap. Several small holes can be punched in these insulating washers which will permit the spark to jump. The pile of half a dozen or more of these large parts can be held together by the pressure on the cross support which holds the insulated bushing and binding post (the latter not shown) that go with the small electrode adjusting shaft or bolt. All these parts can be mounted on a porcelain fixture base or any good insulating substance.

Contributed by R. U. CLARK, 3D.

Simple Amplifying Transformers and Mountings

The amplifying transformer of to-day is so well made and so reasonably priced that very few radio men care to undertake the construction of such a device, but there are some who might like to buy the parts and mount them to suit themselves.

Any experimenter who wishes to save time and expense in making up a neat mounting for the above mentioned device may be able to get some helpful ideas from the illustration of one simple type of base, core and support which can be constructed from materials of a standard nature that require little alteration to make them of use.

The base of the instrument is made from a second-hand porcelain socket base of the kind used with old or new style electric wall lamp sockets. The center of this is slightly lower than the rest, thus forming a sort of nest for the metal cup, also part of an electric light fixture taken from an old chandelier, to fit in.

The core of the transformer is made of sheet steel well annealed, the circular pieces being made from steel split washers of the kind used on Ford Autos for keeping the felt wheel packing in place. These are sawed out on the inside when necessary to make the coil fit in place easily. The smallest coils will, however, fit without any need of cutting away the metal here.

All of the parts just mentioned are clampt to the base by two vertical bolts which hold the instrument together. The

(*Continued on page* 118)

Here is a Way to Build Small Amplifying Transformers at Minimum Cost

Some Notes On A Good Amplifier

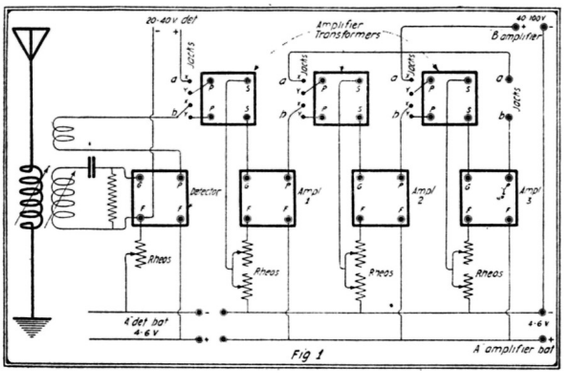
By LOUIS FUNKE*

THE amplifier described below has been in use for some months, and it is of such simplicity of construction that no special knowledge is required to build it. First purchase the amplifying transformers, rheostats, jacks and panel material, etc., and then proceed with a straight wiring job. Those bugbears of amplifier experimenters, grid leaks and grid condensers are conspicuous by their absence in this amplifier.

The secret is to apply a suitable negative potential to the grids of the amplifier tubes by utilizing the potential drop across the "A" battery when the filament is at incandescence. In other words, apply the potentiometer principle to the grid circuit. In order to be able to apply any potential (within the necessary limits) to the grid, two rheostats are connected in series with each filament, and the grid connection, after going through the secondary of the amplifying transformer, is brought to the middle point of these rheostats, that is, the wire connecting them. The diagram in Fig. 1 makes this very clear. By manipulating the rheostats, the amount of resistance on either side of this connecting wire, is varied, and hence the actual potential of this part of the circuit is controlled.

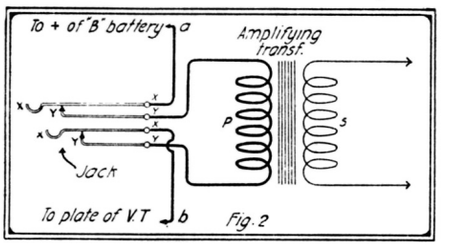
All the symbols in the diagram have the usual meaning.

*Manager Radio Dept., Bamberger's, Newark, N. J.



Complete Circuit Diagram of the Three Step Amplifier and Detector Which Has Given Mr. Funke Excellent Results

Here is the explanation of Fig. 2 as shown, XX make contact with YY, thus



Specific Wiring Detail of the Plug and Jack System

placing primary of amplifying transformer in circuit with the plate and "B" battery of the VT.

When a plug is inserted, XX are pushed apart from YY throwing primary of transformer out of circuit. The plug makes contact with XX, however, placing the telephones (which are connected to the plug) in series with the plate and "B" battery. Hence the transformer or phones may be caused to function in any particular step. The last step need have no YY terminals.

DATA ON LAY-OUT.

The lay-out of the different items can be as in diagram, except perhaps that the "B" battery terminals can be brought lower down.

Adjacent amplifying transformers must be at least two inches apart and at right angles to one another. Materials needed for the system are:

3 VT sockets.
3 amplifying transformers.
3 two-circuit jacks.
6 panel-type rheostats.
6 binding posts.

Panel 10 x 12 x 3/16" bakelite or as desired.

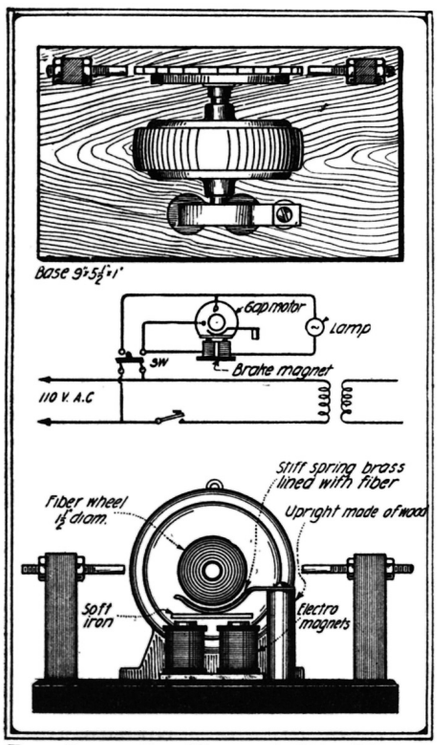
Screws, nuts, washers, according to design.

30 40-ft. electrician's fixture wire (insulated) for connections. Solder all connections.

The sockets are mounted on a horizontal shelf at the back of the panel and peep holes are provided to observe filaments.

High Efficiency Spark Gap

By ALFRED LINDSAY



Two Perspective Views of This Efficient Spark Gap as Well as Wiring Diagram of the Brake Arrangement.

The rotor of this spark gap is made from a piece of copper five inches in diameter with a hole cut three inches in diameter. The teeth, or sparking points, can be cut out with a hack saw and finisht off with a file and the holes drilled for mounting on the insulating disk.

The uprights are made of bakelite; if bakelite cannot be obtained, wood or other insulating material will do. The bottom is drilled and tapt for machine screws, this is for fastening to base. The top is drilled just big enough to permit the electrode to pass thru.

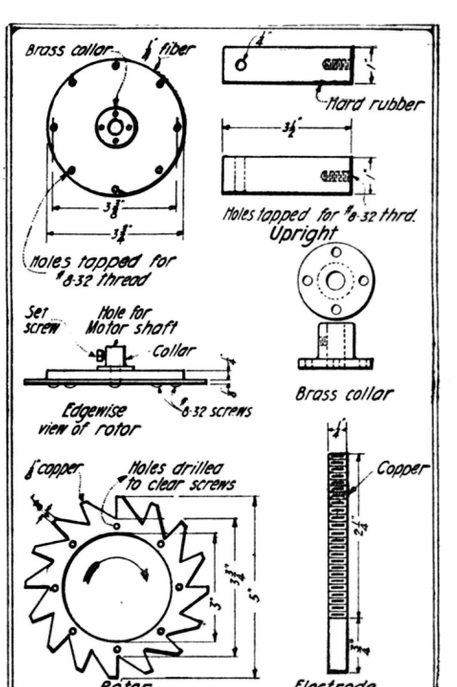
The latter is made of copper and threaded about two-thirds of its length.

We will now turn to the main feature, and that is the magnetic brake. The brake band is made of stiff spring brass, lined on the inside with fiber and on the outside a piece of soft iron is fastened. The electro-magnets can be obtained from an old bell, preferably a large one.

The action of the brake is as follows, when the motor is running the magnets are excited and the brake band is held down. When the current is off the band is released and rubs against the fiber pulley, thus stopping the motor.

You will notice that the rotor is patterned somewhat after a circular saw rotating backwards so that there is an instantaneous break and all danger of the spark to drag is avoided.

The brake magnet is placed in series with a lamp and then shunted across the terminals of the motor.



Detailed Construction Data on the Various Parts Necessary to Build the Gap. Note the Teeth of the Rotor Which Form Excellent Sparking Points. Looks Somewhat Like a Circular Saw.

THE RADIO CONSTRUCTOR

Vacuum Tube Controlling Units

By J. STANLEY BROWN*

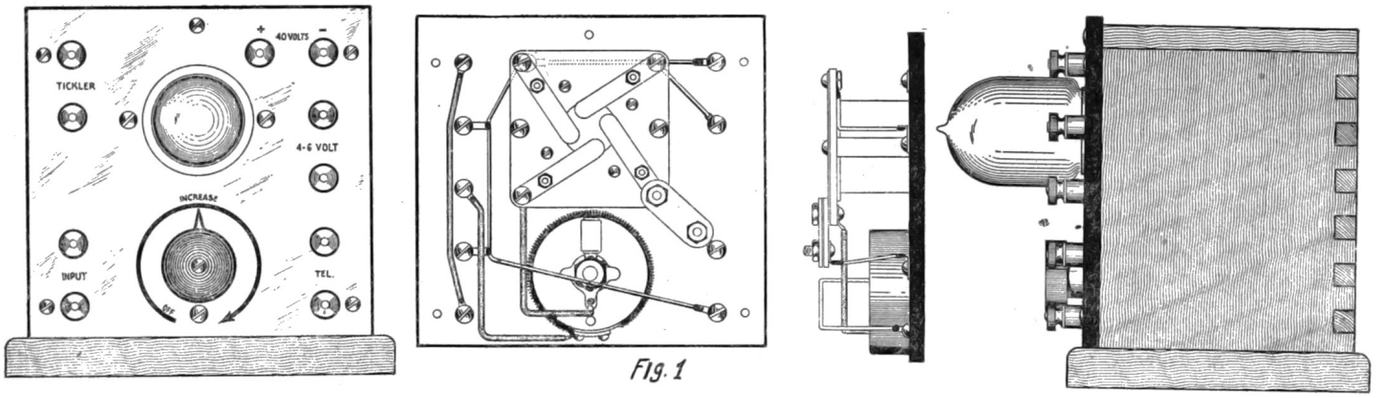


Fig. 1

Four Views of the Vacuum Tube Control Panel Assembly. These Sketches Serve to Give a Good Idea of the Necessary Parts. To the Extreme Left Is Shown a Sketch of How the Front of Panel Should Appear. In the Center Is Shown a Back View of the Panel Connections. To the Extreme Right Is Shown a Side View of the Instrument in the Box in Which It Is Contained. By Following Out the General Method of Assembly Employed by Mr. Brown a Very Businesslike Instrument Will Reward the Constructor's Efforts.

In the March issue of RADIO AMATEUR NEWS *there were constructional details of a fine little set for short wave reception which in actual practise has proven very popular. The writer has received letters from many amateurs who have built the set and secured the best of results with it. This led to the designing of a vacuum tube controlling panel and a two-stage amplifier that are of such size as to permit strap-connection of the binding posts from one unit to another and to the short wave set just mentioned. These designs are about to go into production, and if the amateur does not wish to construct them, he may secure them on the market.*

AN assembly drawing of the vacuum tube control panel is shown in Fig. 1, and it should serve to give one a very good idea of the component parts. The panel is made of ¼ inch Formica and is best given a grain finish. The socket should be any of the standard ones now upon the market. No dimensions are given for the entire instrument, as it should be built to the same height as the short wave set before mentioned. The rheostat is more novel than any other feature of the set, as it is but two inches in diameter. It is wound to a resistance of ten ohms on a fibre form 1/32 inch by ⅝ inch, which is notched on the edge, twenty-four notches to the inch. A little more than 13 feet of wire is required. After this strip is wound with wire it is screwed to the periphery of a ¼-inch Formica disc, 1⅞ inches diameter. This disc is held on center by the shaft and to the panel by a flat-head No. 8-32 machine screw. This screw is long enough so that it acts as a stop for the contactor arm, as well as to furnish a means of fastening. The shaft and knob are identical in construction to the shaft and knob used for the short-wave set, except that the shaft is a little longer and that the knob has an arrow engraved upon it. An original feature of this rheostat is the means of making contact with the different turns of wire. A punched and formed piece, similar to a copper tubing connection lug, is held on the shaft between two ¼-inch No. 24 nuts. The diameter of the hole is ¼ inch. The rear of it is closed up and a small coil spring of the compression type is inserted. After this an oval-nosed plug of ¼-inch brass rod is put into place to serve as a contact. It should move freely but not loosely in the lug. A four-legged spring washer with a solder lug is placed under the bottom nut to serve as a means of connection and tension regulation.

One may see the exact connections by looking at the rear view of the panel. They should be of No. 14 hard drawn copper wire and covered with Empire Cloth Tubing at the points indicated. It is highly essential in the construction of vacuum tube apparatus that a *non-corrosive flux* be used when soldering.

The case for the instrument under discussion is made of birch and given a good mahogany finish. It should be of the same height and thickness as that made for the short wave set previously mentioned.

THE TWO-STAGE AUDIO FREQUENCY AMPLIFIER

The necessity of an instrument to supply the demand for a compact and simple two-stage audio frequency amplifier caused the design shown in Fig. 2. As will be noticed, it is very small and compact and makes use of two Federal audio frequency amplifier transformers. No means of plugging in successive stages of amplification is provided, as it would complicate the construction to a considerable extent beyond the point that would be warranted when trying to design a simple amplifying unit. It will be noticed that there is no filament switch, but it will be found unnecessary upon closer inspection of the rheostats, as they are so constructed as to allow the contactor to run off of the winding when the operator cuts all of the resistance out of the circuit. This is of value as a means of protection, as the Marconi Vacuum Tubes takes but 0.7 ampere of filament current and the battery, which should be a 4-volt one, is usually replaced by a 6-volt storage unit in most sets and is apt to recuperate to a great enough voltage, when charged, to burn out the filament *if the*

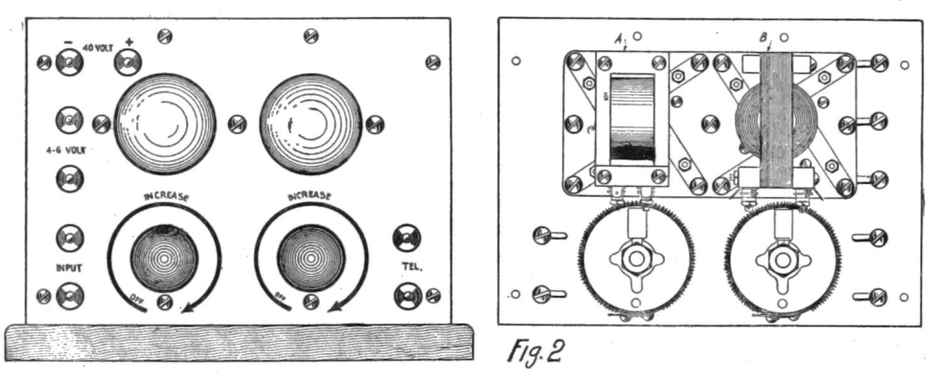
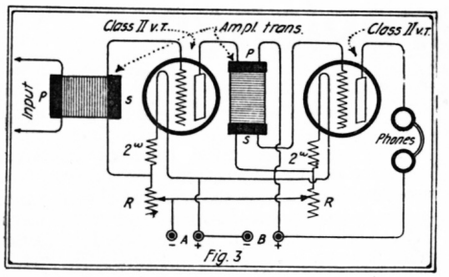


Fig. 2

The Necessity of an Instrument to Supply the Demand for a Compact Two-Stage Audio Frequency Amplifier Caused the Design Shown In These Two Illustrations. The Sketch to the Left Is the Front View While the Sketch to the Right Is the Back View of the Amplifier.

* *Radio Engineer, Signal Electric Mfg. Company.*



Here Is a Diagram of the Connections Which May Be Employed In Hooking Up This Two-Stage Amplifier.

rheostat is left at the same value of resistance as before charging. With this means of filament cut off, it is necessary to make the filament circuit with *all* of the resistance in.

The mounting feet are taken off the amplifying transformers and they are mounted in the manner shown in details A and B of Fig. 4. It is quite essential that they be mounted at right angles to each other. It is rather desirable in most cases to *ground their cores* and also the negative side of the filament. It is not necessary that Federal Transformers be used, but they lend themselves very well to the design, are of the correct impedance for the Marconi Tube and are the smallest obtainable. However, most any other dependable type may be employed, the builder making the necessary construction changes in the manner of mounting them.

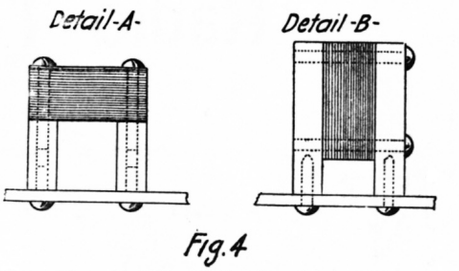
The connections are shown in Fig. 3. The negative resistance is best determined by experiment, although for the transformers under discussion it should be of the order of 2 or 2½ ohms. It will be found to be a different value for different types of bulbs. Make the connections of the same wire as used for the vacuum tube control panel. In other words, these should preferably be of No. 14 copper wire, covered with Empire Cloth Tubing, and, when necessary to use a fool-proof joint, employ resin-core solder.

CONSTRUCTIONAL POINTS

The panel of the control panel is ¼ x 5¼ inches high by 5½ inches long, while the amplifier panel is the same thickness and height, but is 7¼ inches long.

The grid condenser on the control panel may be seen extending from the right-hand corner of the vacuum tube base. It is made with a mica dielectric to a capacity of 100 m.-mfds. (micro-microfarad) and is shunted by a 2-megohm (two million ohms) grid leak, which may be made by dipping a strip of drawing paper in India ink and measuring on a bridge. The grid leak-condenser unit is then clamped together with a couple of machine screws and dipped in shellack and baked.

Place the input posts on the control panel so as to permit neat-looking strap connection to the secondary posts on the short wave set mentioned before. Follow the same procedure with the tickler. The input posts on the amplifier panel should be so placed as to permit strap connections to the telephone posts on the control panel. Respective A battery posts are opposite and negative B battery posts should correspond. The placing of positive B battery posts permits a fairly short connection between them.



These Two Details of the Amplifying Transformers Show Method of Mounting. It Will Be Noted That They Are at Right Angles to Each Other.

With the above ideas set forth it is my hope that some of the more progressive experimenters will build themselves some similar equipment, as it is my belief that this is the class of apparatus coming more and more into use as amateur radio advances.

The Construction of a Cage Type Antenna

By LLOYD C. GREENE

AMONG the vast number of new ideas in radio brought out by the late war is one of which little, if anything, has been written in amateur radio publications, and perhaps for no other reason than that because of its simplicity it has failed to attract attention in the presence of more complicated developments which are so often a source of mystery and allurement to the amateur. But now that the magazines seem to have devoted a very generous amount of publicity to the "19-stage audio-frequency amplifiers" and the "100-horsepower loud speakers," during the past few months (all of which, we will admit, is very interesting to know about), it occurs to us that it would not be altogether improper to perpetrate a little bit of something practical upon the serious-minded ones of our great amateur fraternity. Therefore, without further wordy discourse, allow us to introduce to you the *cage antenna.* It is a development of the British Royal Navy, and that this type of antenna is one of considerable merit is borne out by the fact that it has been adopted by our own navy, and is now installed on a large number of our fighting ships from the super-dreadnought and battle cruiser class down to the smaller craft of the destroyer and sub-chaser class.

Its installation and satisfactory operation on the smaller ships should suggest to the progressive amateur the possibilities of this type of antenna in 200-meter work. Electrically this antenna is the equal, if not the peer, in efficiency of any flat-top antenna (now in use by most amateurs) approaching it in physical dimensions; it has actually increased radiation, at short wave lengths, other conditions being equal, and in addition, from a constructional standpoint, has these further advantages:

It is extremely light in weight, due to the elimination of spreaders, insulators and bridles. Because of this fact, it may be supported by very light masts and without an elaborate system of guy wires. It collects a negligible amount of snow and sleet in winter, and offers a minimum of resistance to high winds. During the severe winter just past this type of antenna (which is now in use in the First Naval District by a few amateurs who have learned of its advantages over the old "reliable" (?) flat-top) was swinging high when many a flat-top was reposing peacefully in a snowdrift out in the back yard.

THE NECESSARY MATERIAL.

The material necessary for the construction of the antenna is as follows:

4 wooden hoops, preferably ship's mast hoops, 15″ diameter;
2 doz. 2″ 8/32 round head machine screws;
2 doz. 8/32 nuts;
4 doz. washers for screws;
12′ No. 16 galv. iron wire;
330′ antenna wire, preferably 7-strand, tinned copper;
2 10″ electrose insulators.

Note.—Wooden Bicycle wheel rims may be substituted for ship's mast hoops, in which case it is left to the ingenuity of the amateur to work out his own constructional details. Mr. Austin Rowe of Winthrop, Mass., finds a satisfactory method of employing rims.

CONSTRUCTION.

Space the circumference of the hoops into six equal parts; drill holes through rim of hoops from outside circumference at the spaced points with No. 29 drill; after drilling all four hoops, insert screws from the inside, placing a washer between the head of each screw and the inside of the hoop rim to give screw head a bearing on the wood; from the outside, where the screws protrude, place another washer and a nut, but do not secure nut yet. Next cut the 12′ piece of galvanized iron wire into 6″-lengths; each of these 6″-lengths is to act as a "fastener" to secure the hoops to the antenna strands and should be put on the

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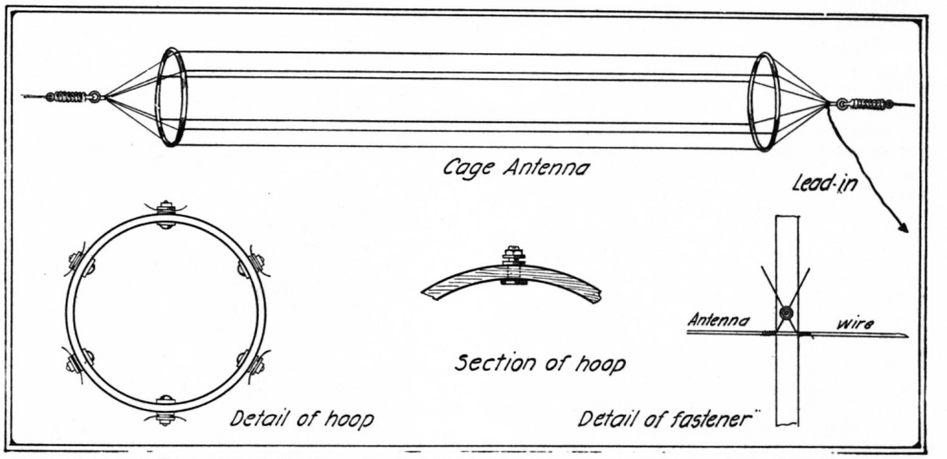
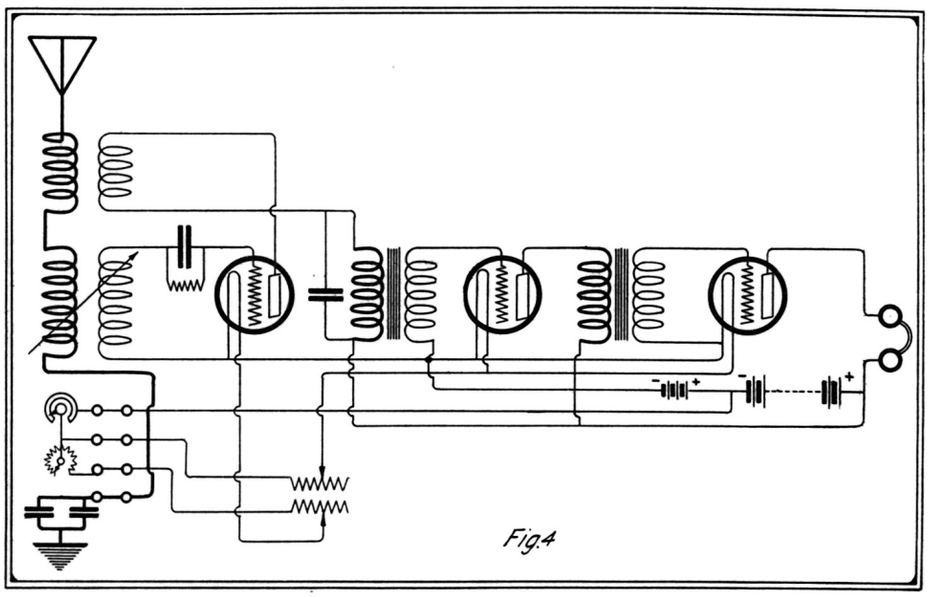


General Detail Plan of the Various Parts Which Enter Into the Construction of a Cage Type Antenna. Altho This Type of Antenna Is at Present Not Very Well Known by Many Amateurs, Its Simplicity and Effectiveness Is Destined to Make It Very Popular. Let Us Hear a Few Good Accounts of Its Use in the Near Future.

Radio Telephony on Aeroplanes

By MAJOR C. E. PRINCE, O. B. E.



In Some Air Trials With Early Types of Soft-valve Receiver, It was Noticed That to Alter the Filament Brightness of This Circuit Made a Very Convenient Way of Finally Controlling the Action After the Circuit Had Been Set Near the Critical Point.

THE summer of 1915 is believed to have been the very first occasion when wireless speech was received from an aeroplane. At that period the soft valve was in use, with a lime-coated platinum filament, and the handling of this by unskilled persons was one of the greatest difficulties. Except for this, the purely electrical difficulties have thruout been far less serious than the telephonic, practical and mechanical ones.

In the early stages the difficulties of reception of speech in the air were so great that only transmission from air to ground was attempted, and the first practical set evolved was a transmitter, capable of employing either speech, continuous wave, or interrupted continuous wave (subsequently called "tonic train").

It was essentially a self-contained oscillating system, to which the aerial was loosely coupled. The microphone was inserted in the earth-lead, and modulated the radiation by varying the resistance of the aerial. Some of the best ground microphones proved useless in the air, and the choice finally rested on an old-type Hunnings Cone. It is almost impossible to predict from its behavior on the ground whether any particular microphone or type of microphone will work satisfactorily in an aeroplane; and in the Royal Air Force every individual instrument was tested actually in the air.

The set was used on a trailing aerial 250 ft. long, and employed a wavelength of approximately 300 meters, not very far removed from the natural wavelength of the aerial. In consequence, the radiation was very good.

The author was admirably assisted in the production of this set by Lieut. (now Capt.) McDougald, R.A.F.; it was the first practical aeroplane telephone ever produced.

This transmission was at first received on the ground on a Marconi double-magnification circuit in which a single soft valve was employed for both high-frequency and low-frequency magnification, a carborundum crystal being used for rectification. The ordinary working limit of range from air to ground was about 20 miles for telephony, 30 to 35 for tonic train, and about double this distance for pure continuous-wave transmission.

The author made up a valve receiver with one soft valve, with practically similar circuits to the ground set, which was tested in the autumn of 1916, and ranges of from 30 to 50 miles were obtained from a ½-k.w. spark set. It was on this receiver that intelligible speech was first heard in the air.

The overseas Forces did not for a long time make any use of air-to-ground telephony; an urgent demand arose, however, for telephonic communication between machines in the air, and all energies were devoted to solving this far more difficult problem. There was for a long time no demand for both-way working, and a machine was equipt either for transmission (for the leader to give orders), or reception (for his formation to receive them).

It was necessary to eliminate all possible adjustments; the transmitting apparatus had none, and the receiving apparatus on. two, one of which was seldom touched.

A reliable, small, hard transmitting valve of French type, capable of handling about 20 watts, and similar valves with slightly more open grid for use in reception, became available.

Dealing first with the transmitting apparatus, an ordinary reaction or regenerative circuit provided the radio power and the only electrical difficulty was the choice of the best method of applying the voice modulations. The coupled-circuit system was ruled out on account of the coupling and tuning adjustments and its output limitations.

In comparing different means of modulation, variations of intensity or output are always accompanied by some change of wavelength, and the receiver can be adapted to take advantage of one or the other factor. In practise both factors can be laid under contribution, tho probably the ideal method of modulation would change intensity only.

In any system in which the change of wavelength preponderates, good or bad articulation can be produced on a reaction receiver according to the slope of the resonance curve on which the adjustment is made.

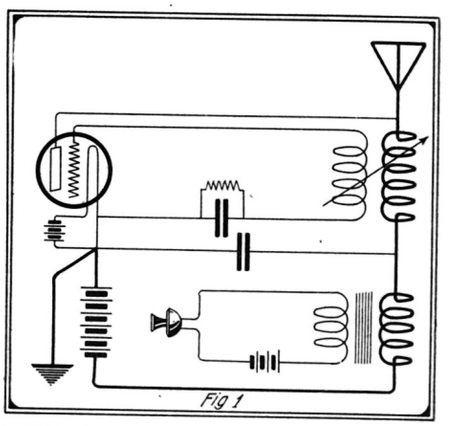
No method of controlling the radiation directly by the microphone proved free from grave disadvantages, and the choice therefore fell on some form of indirect control. The arrangement finally adopted is generally known as "choke control," in which the modulation is applied to the anode circuit of the control valve.

Let us suppose that in the anode feed circuit of a simple valve oscillator is placed the secondary winding of an ordinary step-up transformer, the primary of which is a microphone and battery circuit (Fig. 1). The variations produced by the voice will give rise to changes of potential in the anode feed circuit, which will be equivalent to applying to the oscillating valve more or less high tension, and will alter the radiation in a sympathetic manner. Since, however, the energy dealt with will be weak compared with the main supply, success will be only partial. For magnifying this effect let us now introduce another or "control" valve whose grid is acted on by the original microphone transformer, and whose anode is in series with a one-to-one transformer in place of the original one (Fig. 2). If the two valves are comparable and have applied to them similar high tension, we are now able to apply a modulation or variation of the same order as the energy dealt with by the first or "power" valve.

From this point easy steps take us to the actual circuit employed. The control valve can be supplied from the same source of high tension as the power valve; the transformer can become a choke coil (which is, in effect, a one-to-one transformer), and it is an obvious arrangement to work the filaments and the microphone primary circuit off the same low-tension battery.

The circuit now becomes as shown in Fig. 3, in which P is the power and C the control valve, L is the choke coil, and T the microphone transformer. HT is the source of high-tension supply, and F is the filament battery.

It will be seen that the anodes of both valves draw their high-tension D.C. supply through the choke winding, and as long as the microphone is quiescent, the output and general behavior do not differ from that of the power circuit considered as a plain one-valve oscillator. When, however, variations take place in the control-valve anode circuit at speech frequency, very large surges are set up in that of the power valve, which may approximate to the original high-tension D.C. potential and so sweep the output from nearly double its steady value to almost zero.



In This Diagram, the Anode Feed Circuit of a Simple Valve Oscillator Is Placed in the Secondary Winding of an Ordinary Step up Transformer.

Choke control proved pre-eminently suitable for air working, and no other method of modulation survived in competition with it. There are absolutely no critical adjustments to be made. Almost every constant can be changed within quite wide limits, and tho it may thus be caused to work more or less efficiently, it never reaches a point of complete failure.

The little 20-watt choke control set, designed by the author on the principles outlined above, was very successful, and became the standard R.A.F. set with which all the air transmission has, up to the present, been done.

One of its features, which was largely responsible for its success, was the use of "remote control." Things were so arranged that the set proper could be mounted at a distance in any convenient position, and only a very small control unit for operating it was brought within reach of the user's hand. In the case of the transmitter no adjustments were necessary. The control unit carried only a switch, an aerial ammeter, and plugs for microphone and telephone receiver.

The switch made or broke the dynamo field, filament, and microphone circuits, so that when it was off every circuit was dead. It was necessary merely to switch on and talk. Simplification could go no further; but how necessary this was can only be appreciated, perhaps, by those familiar with air work.

Although the first telephone had been supplied with high-tension current from dry cells, these were completely superseded by small air-driven generators, the improved descendants of one made for the author by Mr. Mackie early in 1916. The standard generator adopted gave about 600 volts from one commutator at its normal speed of 4,000 R.P.M., while the 6-volt filament accumulators were floating across the low-tension side. Moderately good electrical regulation was provided by a demagnetizing field-winding system, and in this way the size of the accumulator had not to be very great.

It was found to be highly important that the speaker should be able to hear the effect of his own voice, and to do this in the simplest possible way a condenser was placed in the earth lead, and across it a pair of head receivers was connected, which were thus enabled to pick up the low-frequency effect. By connecting another pair in parallel, the other occupant of the aeroplane could also hear what orders were given.

Mechanical disturbance of the microphone is almost completely eliminated by holding the microphone in the hand—the finest possible shock absorber. The acoustical difficulties are far worse, as the noises which it is desirable to reject are of the same order as the sounds that are to be accepted.

After much experiment the Gordian knot was cut by devising a microphone almost insensitive to sounds of the noise intensity, but responsive to the powerful concentrated sound waves of a voice impinging upon it from a very short distance. The voice was raised to a higher power, as it were, by speaking very loudly, and thus two distinct orders of intensity were produced, which could be separated. By choosing a suitable thickness of diaphragm, size of granule, tightness of packing, etc., combined with heavy damping, a satisfactory microphone was arrived at. It appeared curiously dead and ineffective on the ground, but seemed to take on a new sprightliness in the air.

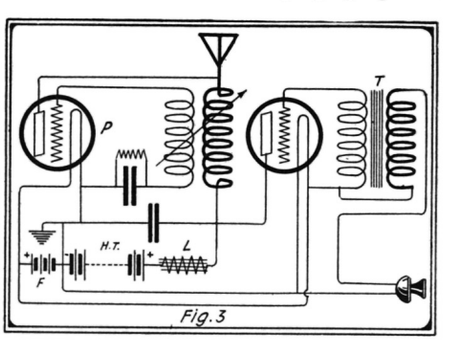


Fig. 3

Finally This Is the Actual Circuit Employed Where the Anodes of Both Valves Draw Their Very High Plate Potentials Through the Choke Coil Winding.

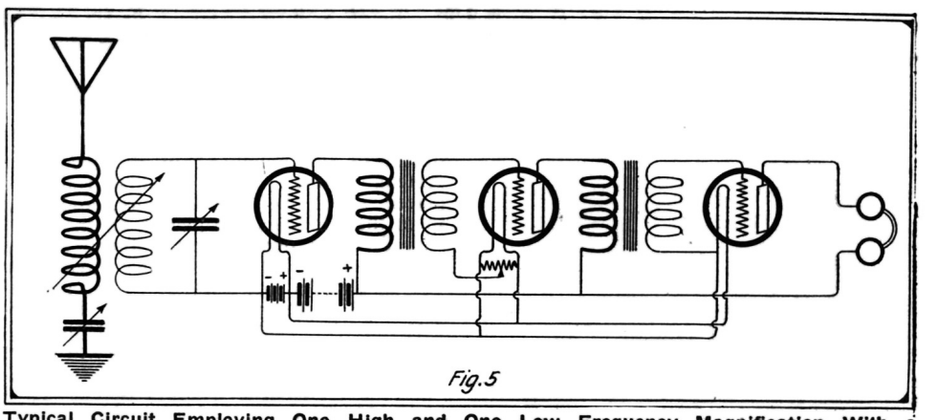


Fig. 5

Typical Circuit Employing One High and One Low Frequency Magnification With a Fine-Grid Rectifying Valve Between.

We now turn from transmitting to its complement, receiving in the air. When the general uproar is remembered, the difficulties need no emphasis. The problem here was to combine considerable sensitiveness, loud signals free from distortion, and the minimum of adjustment.

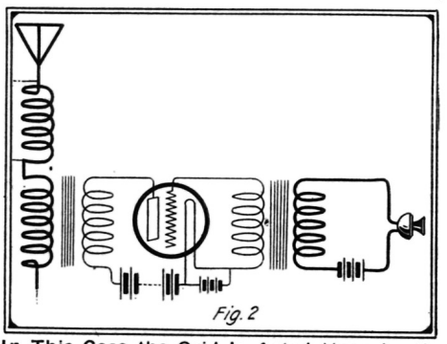


Fig. 2

In This Case the Grid Is Acted Upon by the Original Microphone Transformers Whose Anode Is in Series With a One to One Transformer.

The arrangement which, as the fittest, survived, consisted essentially of a detector valve with reaction, and two note magnifications. The detector valve was not energized direct from the aerial, but thru a so-called "aperiodic" circuit which was really a circuit approximately syntonized by its self-capacity. This has always been found to reduce magneto noise considerably.

In some air-trials with the early 1916 soft-valve receiver, it was noticed that to alter the filament brightness made a very convenient way of finally controlling the reaction, after the circuit had been set near the critical point.

The principle involved is that the increase in emission caused by brightening the filament of the detector valve, whose anode current is concerned in the reaction, steepens the characteristic curve and so determines the oscillatory condition, when the circuits have been adjusted near the critical point; to alter the reaction electrically in this way makes but an infinitesimal change in wavelength, whereas in mechanical methods small changes of capacity are inevitable with every adjustment.

The remainder of the receiving circuits will be clearly understood from Fig. 4.

Prior to the war high-frequency magnification by resonance methods had been in use; transformers with an iron core, highly laminated, were employed to deal with wireless frequencies, and worked efficiently over large ranges of wavelengths. Capt. Round showed how all such transformers could be considered to be essentially resonance transformers, differing only in damping. Special low-capacity valves were introduced, so that the damping produced by them could be made a maximum, and high-frequency magnification was tamed and harnessed. A cascade series of such valves could be set up, working with fairly constant efficiency over a large range of wavelength, so that no tuning (within these limits) was needful except that of the circuit applied to them.

The first fruit of this advance, as far as aircraft sets were concerned, was a five-valve receiver, designed by Major Whiddington, in which a choice was made of two high-frequency magnifications and two low, with a detector valve. This set was, as compared with the former three-valve receiver, about ten times as sensitive for strong signals, and 30 times for weak ones.

It was intended for use with fixt aerials rigidly connected to the wings and fuselage of the aeroplane—as opposed to the trailing aerial, which was a great embarrassment in fighting. In spite of the diminisht radiation of such an aerial, the increased sensibility of this receiver approximately restored the usual range. Fig. 5 represents a typical circuit of this kind and shows one high and one low-frequency magnification, with a fine-grid rectifying valve between. Increased sensitivity as well as the nearer average approach of the aerial system to the source of disturbance, made more apparent, however, one of the great bugbears of air work where great sensitiveness is necessary—magneto noise.

Since the new type of receiver had not come into general use up to the time of the armistice, all the actual work was done with the three-valve receiver and transmitter already described. Trailing aerial wires of 120-ft. length were used in the transmitting machines, with an aerial current of the order of 0.4 ampere, while the receiving machines had aerials 80 to 100 ft. in length. The normal safe working range from machine to machine was about 4 miles (tho this was often very much exceeded), while the range to a ground station was from 20 to 50 miles or more.

A squadron of machines equipt with this apparatus could set out and fight or maneuver in formation under the orders of their commander, whose machine only was fitted for transmission. So great was the importance of telephony considered to be, that a special school of wireless telephony was instituted under Capt. Furnival.

A demand for both-way working was easily satisfied by fitting both the standard sets in all necessary machines and arranging some form of switch-over.

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12-Volt Buzzer Transmitter

By D. R. CLEMONS*

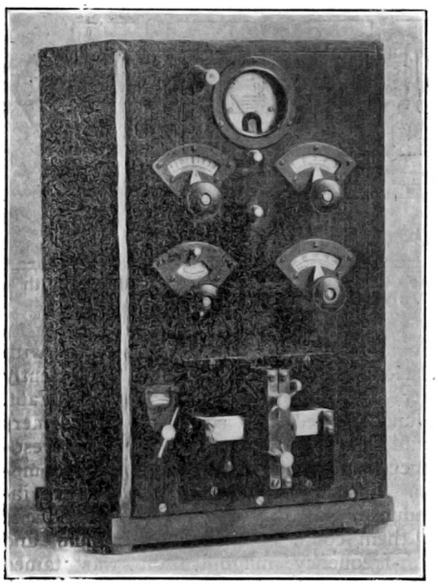

Fig. 2—Front View of the Panel of the Effective Buzzer Transmitter Designed and Built by Mr. Clemons.

AMONG progressive radio experimenters a *low-powered* transmitter is desirable as an auxiliary to the power equipment.

The illustrations show a recently constructed instrument which has functioned so satisfactorily that it might be a valuable addition to any station.

A 12-volt storage battery is the source of power which is ordinarily available in the station or the field. Low-tension primary currents are used in the set, employing the well-known buzzer type of primary excitation. The hook-up is shown in Fig. 1. Wavelengths of 200, 300, 600, 1,200 and 2,400 meters are readily available. The entire equipment is mounted in an oak cabinet 16½ x 10 inches by 8½ inches deep and weighs twenty-six pounds.

A large electro magnet is mounted behind the vibrator panel shown in Fig. 3. The primary inductance and capacity shunts the contacts, as shown by the wiring diagram. In making contact, a powerful magnetic field is created, attracting the vibrator, which moves towards the magnet, finally separating the contacts.

At the instant of contact separation the field collapses and produces a potential in the same direction as the original flow. At this instant the potential becomes very great and jumps the increasing gap, discharging the capacity thru the primary inductance. This impulse induces oscillations in the secondary system, and, as the primary impulse is of short duration, the emitted wave is very sharply defined.

The following instruments are included in the cabinet: a "send-receive" switch, power buzzer, power relay, condenser, primary inductance, secondary inductance, variometer and hot-wire ammeter. All are arranged as shown in Figs. 2 and 3.

A relay having high-resistance windings breaks the primary current. Its windings are in shunt to the power mains and operated by a light key.

Four sections of primary condenser are used for the several wavelengths. Wax paper sheets are used for dielectric mediums. Six turns of cable form the primary inductance.

Two flat spirals of stagger-wound inductances are employed in the secondary system. Eleven wooden radial rods are placed about the wooden core, and thru them the windings are placed, as shown in Fig. 2. The outermost ten turns of the second spiral are tapt to the variometer switch, and provide a range of 150 meters' variation. This value is suitable for corrections when using different antennae.

A primary-wave adjustment switch alters both capacity and inductance values.

The antenna lead passes directly to a brass block mounting a double spring, making contact with the variometer terminal stud when transmitting. Throwing the aerial switch lifts the spring away, providing a circuit to a receiver.

All indicating dials are cut from ⅛-inch rubber battery jars. The scale readings are clampt beneath celluloid sheets—the readings showing thru the openings, as illustrated.

This transmitter draws momentarily 15 to 25 watts, responding evenly to transmissions at high rates of speed without any fluctuating of tone or signal strength. The tone is about two hundred interruptions per second.

On an antenna of 170 meters, with a resistance of 33 ohms at 600 meters, the current is 0.6 ampere.

Using a capacity and directive loop, the current is 1.4, with a resistance of 6 ohms.

I personally designed and built all parts and units entering into its construction with the exception of the hot-wire ammeter, which is of the General Radio Company manufacture. All vibrator parts, switches, coils and other units were machined and made by hand.

Regarding the distance done with the unit: I have made no attempt to test its greatest limit. It was designed for moderate distances required by such auxiliary equipment, and in this work it has done whatever distances it was called upon to do. On days destined for field work, the students of the radio department of the institute are divided into groups and sent into the surrounding country where they set up small receiving stations. Ordinarily the receivers are short lengths of wire suspended from some tree branch or low building. Crystal detectors with simple tuners are used for reception. With such simple equipment, very strong clean signals were received over distances greater than five miles. The transmitter aerial used consisted of two fifty-foot wires suspended thirty-five feet above the earth.

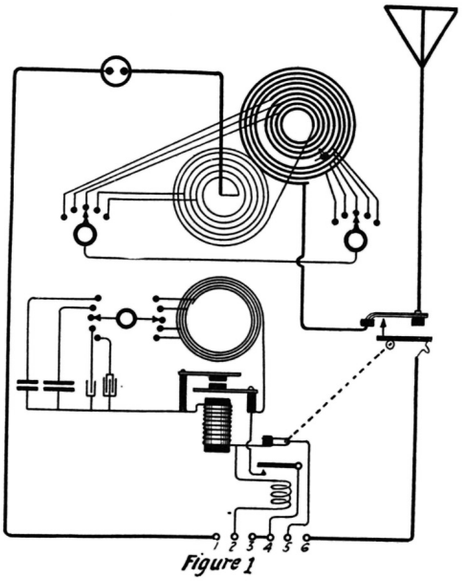

Figure 1

This Is a Diagram of the Hook-Up Employed by the Buzzer Transmitter.

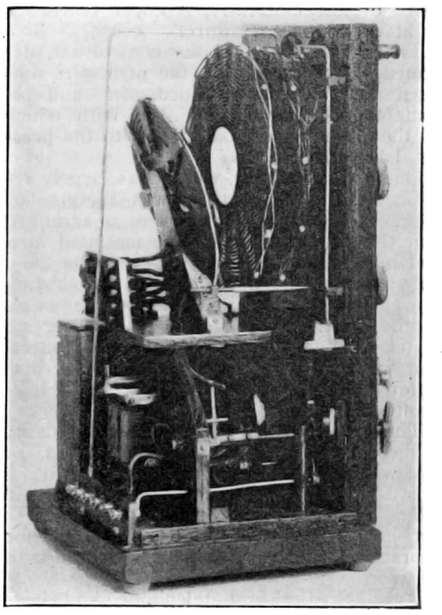

Fig. 3—Side View of the Instrument, Showing the Two Flat Spirals of Stagger-Wound Inductances.

At the receiving stations described, the buzzer transmitter was easily copied thru interference of ordinary magnitude—the audibility being 6 with the 1 to 10 ratio. The receiving stations were not at a greater distance than six miles.

If I were to employ a vacuum tube with one stage of amplification, using efficient antenna at the two points, the stations would undoubtedly do four times the distance over which it has been worked. I should not care to give distances over which the transmitter has been heard, but rather believe the actual working distance with signal strength involved is more desirable in determining the merits of any unit or station.

In conclusion, I shall state that such an instrument is desirable in the various stations where an auxiliary or low power unit is desired. The instrument is not a freak, nor is it a make-shift, but instead, it is a powerful little affair that will do the business in a very efficient way.

FRENCH RADIO EXPERIMENTS.

Valuable experiments in radio telegraphy are being conducted by the French war sloop *Aldebaran,* which has been cruising in the Pacific near the Chatham and Bounty islands. Lieutenant Guierre, wireless expert, will probably submit the result of his experiments to the international radio conference to be held in Washington shortly. He tells us that "reception" in New Zealand from French instruments is of special interest to continental experts, as New Zealand is practically the antipode of France. It is claimed that the *Aldebaran* is carrying out for the first time a truly comprehensive system of measuring the strength of "receptions," altho an American investigator had pioneered the way in this respect.

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Anti-capacity Windings vs. Coil Efficiency

By OSCAR C. ROOS

WHEN an inductor is used in a receiving circuit its useful range of frequency is always limited to an upper value. No one uses a coil near its natural frequency, as the effective coil inductance then increase, due to the coil capacity, forming a *rejector circuit,* which also has an enormous rise of resistance.

Since it is true that *both* inductance and resistance rise near the fundamental, this is less injurious to tuning than the great *variability* of their values in this condition. This makes it advisable to keep the frequency at *less* than *two-thirds* of the fundamental.

The smaller the distributed capacity, the greater the effective range of the coil with a given inductance. The earliest attempt to reduce capacity was to insert a "filler" cord or thread on a single layer coil. For a given number of turns the capacity was cut down considerably and the inductance by about half this amount. A decrease of self capacity or capacity parallel to the axis had been effected.

The next attempt was to decrease capacity along the radius of the coil. This was done as early as 1906, on multi-layer Litz coils by inserting *graded* thicknesses of dielectric between layers. The inner layers had the steepest potential gradient and therefore the thickest layers. Of recent years a similar construction of air-insulated multi-layer inductances has been used by the Bureau of Standards. This form also shows a slight reduction of inductance as an offset to reduced capacity.

The so-called "bank" winding was developt at about the same time as the above —strictly speaking, a little later—and shows the least reduction of inductance for a given number of turns and length of wire of any anti-capacity winding.

This bank winding has a lower efficiency when capacity and resistance at high frequencies are taken into consideration than what may be termed uni-lattice (honeycomb) coils. At short wavelengths this inferiority is less than at others.

The presence of the honeycomb coil and the duolateral or double honeycomb coil on the market requires a new class term for both which will include future coils of the same family. The double honeycomb coil is called the *duolateral* by its inventor, T. P. Giblin, because it crosses from side to side of the winding. All these and similar future windings are really wire "lattices" which is an international word and accurately descriptive.

The honeycomb coil is a uni-lattice coil and the "duolateral coil" is a "bi-lattice coil." The *duolateral* coil is a honeycomb coil with alternate layers staggered. That is, any "layer" advances in its starting point for two separate stops, each one corresponding to a new layer, before the original layer pattern is exactly underneath it again. A "tri-lattice" coil or "multi-lattice" coil can be formed on a handwinding machine in the same manner.

There are multi-lattice coils in which the various lattices are separate. They are called "parallel lattice" coils. A three wire lattice if large, can be used for direction finding.

Fig. 1 shows the elements of a lattice coil. This is called a "cross-step" lattice or for short, a "step-lattice"; since the wire passes from 0R on right face of coil to 186 degrees away at 186L on left face of coil. This is the angular "swing" or simply the "swing." Twice this swing is the angular

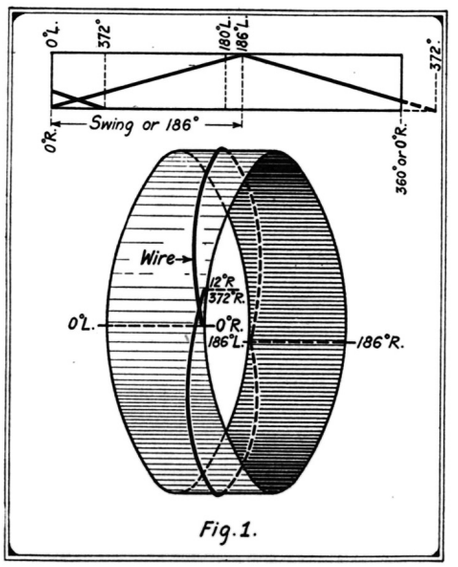


Fig. 1.

Illustrating the Elements of a Lattice-Wound Coil Fully Explained by the Author.

pitch or the "pitch" equal to 372 or 12 degrees, measured from the initial element 0R-0L.

When the swing is greater than 360 degrees, we have a "cross-spiral" or simply a spiral "lattice." The actual length of the step changes as the diameter of the coil increases, but if the average length is taken the coil length can be calculated even more accurately than the ordinary winding, as the wires do not "bed" that is to say, do not fall in grooves formed by adjacent wires.

Such a coil may be wound by starting at the *zero* right hand pin at 0R and going in a "swing" of 186 degrees to the pin at 186L on the left hand face of the frame. Coming back to 372R we find we have an "advance" of 12 degrees in a "pitch" of 372 degrees. Keeping this up thirty times, we complete one "layer" which by the way is twice as deep as an ordinary layer would be on account of the different parts crossing each other.

Now, it should be noted that if instead of being content with one layer we had started *three more* at 3R, 6R and 9R, respectively, we should have just the *same radial* thickness with this "quadri-lattice" winding as with a "uni-lattice" winding. The same thing holds for as many separate windings as can be made to fill up the layer *evenly.* The "quadri-lattice" coil on a five-foot frame makes an excellent direction finder.

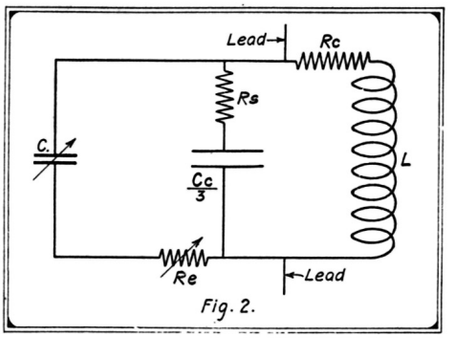


Fig. 2.

This, In Reality, Is a Rejector Circuit, Consisting of the Effective Third of Cc, the Distributed Capacity of the Coil.

These multi-lattice coils have more nearly 100 per cent coupling than anything else in the way of self-coupled inductances. Their use with suitable cores, made by pouring into them a ferrow-dielectric mixture used for radio frequency transformers in 1906 is being developt and patented.

Considering the "lattice" coil as a rejector circuit we ask, "What is its 'stiffness'?" It is $\sqrt{\frac{L}{C}}$ in ohms, if L is in Henries and C in Farads. In Fig. 2, showing a tuning condenser, C and a coil, L of resistance, Rc, we have in reality a rejector circuit consisting of the effective *third* of Cc, the distributed capacity of the coil, as shown by Miller. The high frequency resistance, Re is present and moreover is exceedingly changeable near the "natural" wavelength of the coil. Leakage is partially shown by the resistance, Rs, and is very serious under these conditions.

The capacity, Cc reduces the "range" of the condenser, C. The greater the "stiffness" the closer to the coil "fundamental" may be the permissible wavelength used in Fig. 1 before the value of Re changes and the effective value of L increases out of all proportion to the frequency. It then suddenly collapses and the Re changes to some small value.

As the best way out of these changing criteria, experience shows that we can measure the efficiency of all inductances by a quantity, F. If F is proportional to $\frac{1}{Re}\sqrt{\frac{Le}{Ce}}$, where Le is average effective inductance of coil.
Ce is average capacity of coil.
Re is average resistance of coil.

This is a pure numeric, and strange to say it is the identical expression used by Stone nearly eighteen years ago to measure the selectivity of a series resonant circuit.

It is a fact that the inner layers of a "lattice" coil have less capacity per unit length than the outer, but with practically constant current in the coil the inner layer potential gradient is greater than that in the outer layers. On the other hand, the inductance per unit length is generally less than for the outer layers.

This would seem to indicate that a graded coil as regards size and separation of wires and pitch would give improved efficiency.

PHOTOGRAPHING VIA RADIO.

Transmission of photographs by radio telegraphy will soon be attempted between the Copenhagen newspaper Politiken and England, and later between England and some ship traveling toward America.

The method invented by Professor Arthur Korn will be utilized.

Korn, long associated with the technical high school of Charlottenburg, has devoted a large part of his scientific career to perfection of electrical transmission of photographs. He succeeded with his scheme in 1907 in sending pictures by telegraph between Munich and Berlin, between Berlin and Paris, and between Paris and London.

During the war, he perfected his system insofar that ocean cables could be perfectly used, and now he is hopeful that he can accomplish the same feats by wireless transmission.

The Simplest Hook-Up

By THOMAS W. BENSON and CHARLES S. WOLFE

As the engine wheezed into silence, Roy made his way, electric torch in hand, to the bow of the launch to ascertain the extent of the damage.

For the racking jar and sudden slithering stop had told him that he had struck a submerged obstacle of some kind.

A few moments of probing with the boat hook revealed the none too comforting fact that in the darkness he had run onto one of the lake's sand bars.

A glance at his watch told him that it was after eleven o'clock. With a two hour run across the lake in front of him, the situation was exasperating.

He listened intensely for the throb of other motors, hoping that some one else might chance to be navigating the water in his vicinity. No splutter of exhaust reached his straining ears, a fact not to be wondered at, for this portion of the lake was little frequented at any time, and the passing of a launch at nearly midnight was an unusual event at this particular point.

It was evident that he would have to rely on his own efforts to extricate himself from the predicament.

Accordingly he set to work. Followed fifteen minutes of Herculean and rather profane effort with the boat hook, efforts which failed to budge the tightly imbedded launch an inch.

Abandoning this expedient as useless, he bethought himself of the possibility of reversing the engine and backing her off under her own power.

The little five horse Grey puttered nobly for four or five minutes, at the end of which time the sudden rising whine of a racing engine warned of a propeller wheel lost from the shaft.

This was catastrophe indeed. For even if he did succeed in worrying the launch loose from the bar, Roy realized that he was faced by the laborious task of paddling the twenty foot launch to shore. Experience had not left him ignorant of the fact that a twenty foot launch, while a very satisfactory power boat, is not a howling success as a canoe.

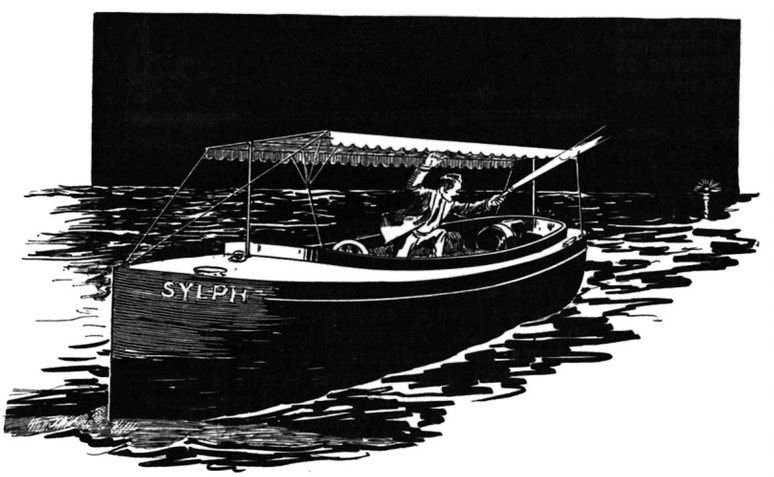
He gave over all efforts for the time, and dropped onto the cushions to think. With physical effort at a standstill came realization of the chill, damp air of the lake, a chill that promised to penetrate to the bone.

Shivering there at the now useless wheel, he indulged in a regular debauch of wishing. He wisht that he had not met the girl in the first place. He wisht that she had picked some other site for a bungalow than this God-forsaken shore of Moon Lake. He wisht that he had gone calling in daylight, instead of puffing around after dark. He wisht most heartily that he had followed the impulse he had had a year ago to get a cabin cruiser—or a house boat. In a fix like this a fellow should at least be half way comfortable in a cabin.

Thinking of being comfortable called his attention once more to the weather, and he noted with dismay that the wind was shifting, shifting to a quarter that invariably meant a cold, raw rain. He glanced longingly shoreward, and thought with a shred of satisfaction that the awning over his head would keep off the worst of it.

He wisht that he had heeded old Fred's importunities to remain ashore and pass the evening with Fred's wireless set. He could picture Fred comfortably ensconced in his warm room with all America and half of Europe whispering into his head set.

Thinking of wireless made him wish that he had equipt the boat with some kind of a set, but who would have supposed that there would ever be any real need of a radio set on a calm, inland lake like this one? Any way, there wasn't much room on a twenty foot launch for an aerial, and less for the housing of the apparatus. Just the same, he was willing to bet that he would rig up one somehow when he got out of this fix.



"With a Yell of Exultation, He Grabbed the Electric Torch and Sent Its Feeble Rays Dancing Out Into the Darkness."

The wireless idea gave rise to reflection of the possibility of signalling for assistance. A rocket, for instance, if he only had one. Naturally, he hadn't. A revolver, or a gun. No such luck. He had never consider the meeting with pirates on Moon Lake as a very probable eventuality, and therefore had not seen fit to arm *The Sylph*.

Maybe he could attract attention by using the electric torch, breaking the light flashes up into Continental Code. This presupposed some one afloat on the lake to see the light beams, and he was brought to the forceful realization of the difference between an electric torch and a voltaic arc light.

Nevertheless, the only hope of speedy extrication lay in the success of his efforts to get assistance, for it was obviously impossible for him to get the boat off unaided.

He turned over mentally all the modes of signalling of which he had ever heard, and was forced to reluctantly give over every one, for he either lacked the necessary apparatus, as in the wireless case, or else he was up against the limitations of one sided visual signalling.

There seemed no remedy for it. Here he was until daylight, or possibly even longer.

He fell into an aimless *rêverie,* sitting there on the damp cushions, while his subconscious mind, that usually denied and never tangible guardian of the human race, got busy.

Suddenly, with all the glare of a vivid lightning flash, the idea seared his brain, bringing him, startled, to his feet. It had seemed as tho in letters of fire there had danced before his eyes the words "The Simplest Hook." As he stood there, across his mind rushed recollections of his early days in wireless, and a page of hook ups. Let's see. Aerial, director, 'phones, and ground. Well, that wouldn't help any. He had the ground, all right, lots of the ideal kind. He was surrounded by it. But detector, 'phones, and aerial—conspicuous by their absence. Even at that, he reflected, if he only had a transmitting set, in a pinch he could dispense with the receiving side.

Let's see. The simplest transmitting hook. Transformer—or coil—, spark gap, aerial and ground. By George! Barring the aerial, he had them. For the coil used on the ignition system would answer in a pinch, and a spark gap he could readily contrive. The single blade switch on the battery box would make a crude key, and the storage battery would furnish the primary source of power. Oh, for an aerial!

His roving gaze traveled around the silent craft, helplessly. And then with a whoop of joy he fell to work. For it was worth a try, that bunch of awning uprights.

Possibly fifteen minutes were occupied in rigging up this primitive set. Two spark plugs from his spare engine supplies, laid end to end, had given him a gap. Feverish wiring had joined electrically the several awning uprights and their cross bows. As a sort of a refinement, he had contrived a condenser out of two pieces of sheet copper, altho it proved a mighty clumsy and cumbersome contrivance and the twisted wire connections were not according to Hoyle.

But he was ready for the trial. A little experimenting with the gap brought the best possible adjustment. His fingers closed over the ignition switch, and laboriously he pounded out Fred's call, over and over, followed by a brief statement of his predicament and whereabouts. And then, monotonously, he proceeded to hammer out this remarkable S. O. S. call over and over and over.

An hour later his primary source of power failed him, and he was forced to quit. He sat there in the darkness, wondering whether his signals had been audible at more than a few hundred feet from the launch.

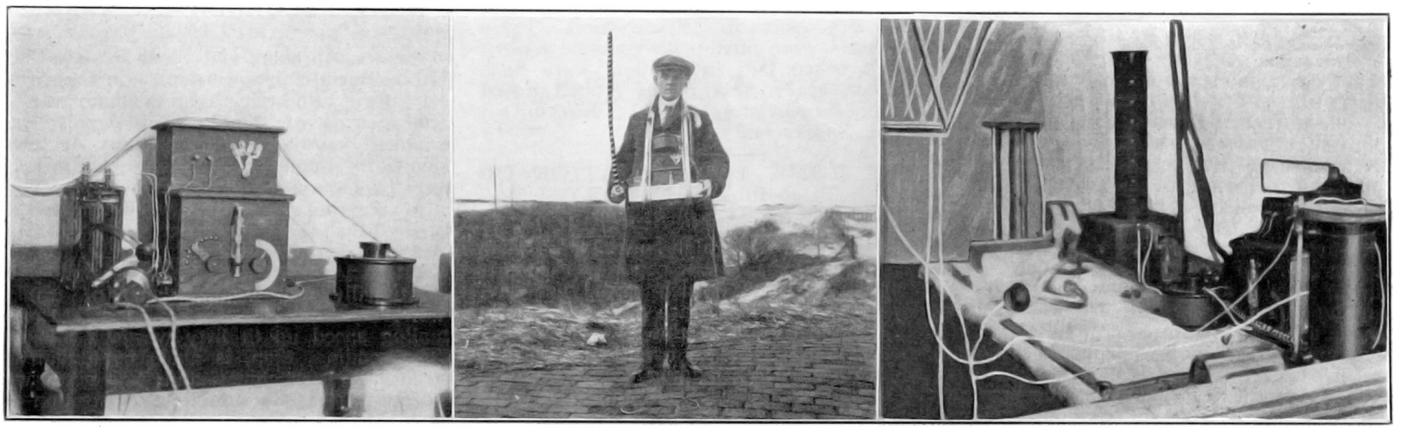
He glanced at his watch. Three o'clock, and with a rustle the first pattering drops of rain fell. And then, thru the darkness, the faint, but ever growing, staccato cracking of exhaust. With a yell of exultation, he grabbed up the electric torch and sent its feeble beams dancing out into the darkness.

As Fred stept aboard, carrying the tow

(*Continued on page* 121)

De Regt Station

An Amateur Station in Holland



We Have Here Three Photographs of a Dutch Radio Experimenter's Activities. To the Right Is Shown a General View of the Receiving Table. The Center Photograph Is That of Mr. De Regt Receiving Messages From a Nearby Coast Station by Means of a Portable Receiving Set and a Walking Stick Aerial. To the Left Is Shown a Short Wave Receiver Capable of Tuning From 240 to 3,000 Meters.

I HAVE reasons to believe that amateurs in America would like to hear something about amateur stations in Holland, so here are several photographs of my station at Noordwyck, near Leyden. The village is one of the largest bathing places along the North Sea shore.

There are so many amateurs in this section that a local club was organized and called "Noordwycksche Radio Club." It is a very active club indeed and is rapidly securing a large membership thruout Holland. You probably know that the Dutch Government does not issue licenses for amateur transmission. For that reason it is therefore impossible to tell you about Dutch sending sets. Receiving, however, is unlimited and the sky is the limit. There being no 200 meter men here the shortest waves in use are those of 300 meters. However, my short wave receiver which may be seen in the extreme left hand photograph, will tune from 240 to 3,000 meters. In this same photograph may be seen the storage cells for the vacuum tube, telephone receivers, the tuner and V. T. control box above which is another box containing the 30-volt B battery, after this comes the series variable condenser.

I also use this set in connection with a loop antenna, a corner of which may be seen in the left hand corner of the right hand photograph. With this latter instrument I am able to ascertain the position of ship stations at sea. In fact, I have even received signals from a ship passing Gibraltar which means a distance of 1900 kilometers from Noordwyck.

The left hand photograph shows a general view of many receiving table. The long wave set was designed for wavelengths ranging from 2,000 to 15,000 meters. Practically all of the instruments are homemade and I must be pardoned if I do say that they are rather effective. I am able to intercept signals from nearly every station in Europe and from Cairo, Port Etienne, Asmara (Erythrea). As for American stations I hear NDD, NFF, NSS, NWW, during the day as well as night. I have even heard messages from Bandveng station, PKX, during the winter time. This is the Dutch Government's high power transmitter located at Java and which is designed to communicate direct with Holland, the distance being approximately 12,000 kilometers.

My antenna consist of two wires 80 meters in length with a lead-in of 20 meters. It is supported by a ten foot mast which is located in a very open section of the country quite near to the sea shore.

The center photograph is of myself in the act of walking on the city boulevard while receiving messages from the nearby Dutch coast station Scheveningenhaven. In this portable set the antenna consists of a wire which has been wound around a walking stick. I secure an aerial connection by dragging a length of wire over the bare ground.

Returning to my regular receiving set I have up to the present date been able to intercept 207 different land stations (amateur stations not included of course), which I may say covers a great part of the world. All this has been done with the use of but one vacuum tube. How about American amateurs, do they hear many more stations than this number? I am interested in the work of American amateurs and for that reason would be glad to correspond with anyone. I feel sure the mutual exchange of ideas would prove interesting.

Zuid Boulevard,
Noordwyck, Holland.

Our Boy's Wireless

By MARY BARTON SMITH

OUR boy has made a wireless,
I tell you I am glad,
The thing is done and all set up:
For sometimes I got mad.
He talked about it all the time,
morning, noon and night—
The dining room was upside down,
The rug was out of sight.

There was saw-dust on the table
And shavings on the floor,
I didn't get to sweep that room
For three whole days or more.
He'd plane and hammer, saw and file,
And scatter things about,
Then he'd make a break for school and—
"Don't touch things," he'd shout.

He'd prowl around and fret and hunt
For things he couldn't find.
And then he'd get a spool of wire
And wind and wind and wind,

I think he wound a thousand miles—
—Of course I can't be sure—
I know I held the spool for him
Until my arms were sore.

He mussed up kettles, pots and pans
To melt the paraffin;
He even got some in the grease,
I had to cook things in.
He used up all of his dad's ink—
He took a china cup—
To mix the mixins in he used,
To stain *the thing* all up.

And when we put the aerial up
I froze myself 'most blue,
But I had helped him all along
And I had to see it thru.

Some people passing in the street
Wondered what it could be,
Professor Budin stopt and asked:
"Is kitty up the tree?"

But now it's done and all set up
And we can hardly think.
It's—"Hush! be still! I hear it buzz!
It's Arlington I think."
Then dad, he looks at me and grins,
—You know we dassn't talk—
And then we just float out the room,
—You know we dassn't walk—

Oh Pshaw! we're just plumb proud of him,
We don't care for the muss,
We want to keep him young in heart
And always loving us.
I'll send a wireless each day
To our great God above;
"O, always keep him sweet and pure—
Protect him with Thy love."

RADIO DIGEST

SIMULTANEOUS TRANSMISSION AND RECEPTION IN RADIO TELEPHONY.

By Noboru Marumo.

In spite of the various devices which have been tried to minimize induction into the receiving system from its own transmitter, the effect has generally been too strong to permit maintaining the detector in sensitive adjustment, and it has been practically impossible to receive signals while the nearby transmitter was radiating. Even tho many inventors have tried to overcome this difficulty, and to succeed in sending and receiving simultaneously in radio telegraphy and telephony, the only practical duplex radio telegraph system seems to have been that of the Marconi Company using their well-known antenna arrangement. This requires sending and receiving stations several miles apart, and is therefore not suitable for adoption in small radio telephonic stations, and particularly not in ship stations. However, the recent development of the vacuum tube has improved conditions considerably, and we have succeeded in permanently connecting receiving and transmitting circuits, even to the same antenna, without objectionable effects.—*Proceedings of the Institute of Radio Engineers.*

USE OF RADIO BY BRITISH PRESS.

On May 11, 1920, *The Daily Mail* achieved the record of being the first London newspaper to install a permanent wireless receiving station on its premises, and after a short period devoted to experiments accomplisht on May 28 a further record, that of being the first British newspaper to receive by wireless telephony news messages for publication. These messages were transmitted by the Chelmsford high power wireless telephony plant belonging to Marconi's Wireless Telegraph Co., Ltd., and received on *The Daily Mail* station in London, the work being done by the paper's own reporters.

In addition to providing amateur wireless men with an especial treat, the demonstration furnisht ample proof that on account of delay in legislation the advantages obtainable from a branch of science, the growth of which was forced in the heat of the Great War, are being allowed to remain to a great extent unplucked for service in the arts of peace.—*Wireless World.*

REMOTE CONTROL RADIO STATION, NAVAL BASE, HAMPTON ROADS, VIRGINIA.

Due to the enormous amount of radio traffic thrust upon the Norfolk Navy Yard radio station and the inability of this station to handle this traffic, the Bureau of Steam Engineering, Navy Department, decided to control remotely the Navy Yard station from the site of the old Jamestown Exposition, a distance of 7.8 miles (12.5 km.) north of the Navy Yard. The underground system having proved efficient for remote control work, it was decided to install the same at the Naval Base to control remotely two 5-kilowatt spark and one 30-kilowatt arc transmitting sets at the Navy Yard.

The site for the control station was selected by the local radio organization, the same being three rooms on the second floor of the administration building and the Bureau of Steam Engineerings' representative had to fit the installation to the allotted quarters. One concrete manhole of hexagonal shape, six feet (1.8 m.) in diameter was constructed in the basement of the above mentioned building directly under the center receiving room. From this manhole trenches were dug in the following directions and consequently the depth of each trench varied in accordance with these depths.

In order to facilitate quick repair to underground wires, concrete manholes 2x3.5x6 feet (0.6x1.1x1.8 m.) were situated 490 feet (149 m.) apart in each direction. These manholes were fitted with concrete covers, which, when laid in position, were flush with the graded level of the ground in that vicinity.—*Proceedings of the Institute of Radio Engineers.*

THE ROME RADIO STATION OF THE ITALIAN NAVY.

By Cyril F. Elwell.

The design of a high-power radio plant under the stress of war conditions tends to emphasize factors which would not have to be considered in peace time. It may be of interest to review the reasoning which resulted in the design hereafter described. Naturally, the outstanding factor was that of time, as the plant was required because of the congestion of both the cable and radio equipment to America, as well as to the Italian colonies in Africa.

Radio Articles in the August Issue of Science and Invention

(Formerly Electrical Experimenter.)

Reserve Officers' Training Corps Demonstrates Wireless.

Use of Radio by Fire Department.

Wireless Telephony on Ship-Board.

$25.00 *Audion Poem Contest—Announcement of the Winner.*

A War-Time Radio Detective. Part IV. By Pierre H. Boucheron.

Magnavox Boosts Radio Signals; With Diagram and Performance Curve of the Apparatus, Compared to the Ordinary Magneto-Attractive Receiver.

Electrical and Radio Amateur Laboratory Contest.

Of the three available forms of antenna support, namely: self-supporting steel towers, guyed steel masts, and guyed wooden masts, the first was immediately rejected as not being compatible with the essential factor of time. The choice then lay between steel and wood. The distance over which good communication was desired being 4,200 miles (7,000 km.), a large effective height was a necessity. For the same height of mast, wood gives an effective height appreciably superior to steel. Altho the highest existing wooden masts were 608 ft. (185 m.) high, it was considered feasible to adopt the same type of construction for masts of 714 ft. (218 m.) in height, without having recourse to excessively large timbers in the bottom sections. To obtain the same effective height with steel, it would have been necessary to erect masts of at least 750 ft. (228 m.), which with the lightest design would have entailed the employment of about 300 tons (27,000 kg.) of fabricated steel for three masts. With demands much above possible production, the factors of price and time of delivery were such as made the decision in favor of 105,000 board feet (248 cu. m.) of pitch pine an easy matter.—*Proceedings of Institute of Radio Engineers.*

HIGH-SPEED RADIO GRAPHICALLY RECORDED BY MEANS OF AMPLIFIERS.

Messrs. Abraham and Bloch explain that altho some attempts were made in the earliest days of radio-telegraphy to obtain graphical records of the received signals, the simplicity and extreme sensitivity of telephone reception very soon caused the universal adoption of the latter system. The oral reception works very well for moderate speed of signalling, such as ten or fifteen words a minute.

Financial considerations and the continually increasing volume of traffic, however, necessitate the use of higher signaling speed up to fifty words a minute. The sending, then, is made by automatic transmitting machines, and it is necessary to return again to automatic registration of the received signals. Photographic registration has been used for scientific purposes, and attempts have been made to employ the dictaphone principle, thereby utilizing the extreme sensitivity of the telephonic reception. However, the real solution seems to lie in the application of vacuum-tube amplifiers. By this means the authors have obtained the most remarkably clear records, not only of most European stations of considerable output, but also of Sayville, Tuckerton, New Brunswick and Annapolis. In these experiments a three-fold amplification was used. The incoming high-frequency oscillations were first sent thru a multi-stage radio-frequency amplifier. The signals were then transformed to an audio-frequency current, which in its turn passed thru several stages of amplification. Finally, the audio signals were "detected" again and changed into dots and dashes which, after passing a special amplifier for very low frequency, were imprest upon the recorder.—*Revue Général d'Electricité.*

CONCERNING MARCONI'S CRUISE.

Much interest has been aroused in both amateur and professional radio circles by the departure of Senatore Marconi for warmer latitudes in his yacht *Elettra.* Added to this natural interest in the movements of a famous scientist is the secret atmosphere which has been so skilfully conjured up by the amateur Merlins of the "street of adventure." We were beginning to hope that the "messages from Mars" hoax had been successfully exploded, but the news of the famous yacht has slightly revived it. It seems a pity that an error apparently perpetrated by a reporter somewhat hard of hearing but possessing a fine sense of what looks well on a contents bill, should enjoy such popularity; therefore let a plain statement be considered. During his cruise he will study a number of wireless problems, notably those connected with the art of direction-finding, altho radio telephony will also receive attention. Is it really necessary to embellish this statement with festoons of planets?—*Wireless World.*

AMATEUR RADIO IN SOUTH AFRICA.

The conditions under which radio licenses will be issued to amateurs in the Cape Colony are identical with those laid down for amateurs in England. Transmission in certain cases is allowed, the name of the person or persons with whose radio installation it is proposed to communicate having to be furnisht to the authorities. Communication beyond a radius of ten miles is forbidden.

EDISON RADIO CLUB, BERKELEY, CALIF.

The Edison Radio Club, of the Edison School, Berkeley, Calif., was recently organized, and held its first meeting in the manual training rooms of the school. A theatre party was recently given by the school, at which about $100 was raised for purchasing radio equipment for the club.

Any boy who goes to the school may join the club. The memberships are divided into four classes, according to the ability of the person. The Club meets every Thursday night at 7:30 o'clock. The first part of the evening is usually taken up by a speaker, and the International Code practised during the remainder of the meeting. The Club has put up a small set temporarily, but intends to install a larger set soon.

The officers of the club are: President, Charles Flanders; Vice-President, Robert Walker; Secretary, Francis Crowl. Mr. Keran, manual training instructor, is the faculty advisor.

Interested persons may communicate with the secretary, care of the Edison School, Berkeley, Calif.

THE WIRELESS SOCIETY OF LONDON.

The meeting of this society, which will be the last to be held this session, took place on June 29, at 8 p. m., at the Royal Society of Arts, John Street, Adelphi.

A paper was read, which was illustrated by experiments, on "Working and Construction of a Small Wireless Telephony Transmitting Apparatus," by Mr. G. G. Blake.

Admiral of the Fleet, Sir Henry B. Jackson, G.C.B., spoke on his recent work in connection with loop aerials and gave particulars of design.

Captain S. R. Mullard, M.B.E., demonstrated some valves and general apparatus.

The visit to the Marconi Works, Chelmsford, took place on June 30. Correspondence relative to the club's activities may be addresst to H. L. McMichael, Hon. Sec., 32 Quex Road, West Hampstead, N.W. 6, England.

CLEVELAND RADIO CLUB.

Officers of the newly organized Cleveland Radio Association were announced Friday.

They are: A. G. Spiller, president; C. J. Carter, vice-president; A. P. Tyler, secretary, and A. R. Stowe, treasurer.

The organization meets the first and third Thursday of the month.

OUTING OF THE RADIO RESEARCH CLUB OF NEW YORK.

The first outing of the R. R. C. was held on July 4, 1920. All the members were present with field-sets, phones, lunch, and a bounteous store of enthusiasm. After arriving there a loop was slung up between four tall trees and the club's set was tested first. The results obtained were so good that a vote was taken immediately to send a description of the set to R. N. We copied commercial stations, ships, and amateurs. After listening in for some time we experimented with underwater aerials but we did not obtain results. We had our lunch under the trees listening drowsily to the big stations huming in. After copying messages for some time longer we reluctantly decided that it was time to make tracks for home. The members were unanimous in their appreciation of the fine time they had and want to thank the program committee for the work they have done for the club.

Some of the places the club has visited due to the efforts of this committee were: The De Forest Radio Tel. and Tel. Co. The Edison Storage Battery Co. The Gould Storage Battery Co. The committee consists of Sam Ellner, Nat Sauberman and Jonas Cohen, Sec't, R. R. C., 789 E. 163rd St., N. Y. C.

INTERESTING DOING OF THE ESSEX COUNTY RADIO ASS'N.

The Essex County Radio Association's plans for a radiophone demonstration that proved so successful that it was the biggest event in Essex county and probably in New England.

This was for Fraternity Lodge of Odd Fellows and consisted of an address by H. C. Gawlor, United States Radio Inspector, followed by an address by William G. Hammond, chairman of Fraternity lodge entertainment committee, music selections and dancing from Hersey's Willows Station to the lodge hall on Washington street, Salem, by radiophone.

F. Clifford Estey and Ralph H. Hersey went to Boston and secured apparatus for exhibition in the window of Rolfe's Music store on Essex street, Salem. This was loaned by the F. D. Pitts company and the Eastern Radio Institute.

Through H. C. Gawler of Boston they secured the aid of Admiral S. S. Robinson of the United States Navy, and used two complete radiophone receivers and transmitters such as have been used so successfully by the Navy. Admiral Robinson is the author of the manual of radio telegraphy for the use of naval electricians and is probably the best authority of radio telephone and telegraph apparatus and its use in the United States.

Forest A. Stainbrook, naval Radio Telephone Expert from Charlesctown Navy Yard, operated the station with Ralph H. Hersey and John Hatch at Salem Willows.

Harry W. Miller, another naval radio telephone expert, also from the navy yard was in charge of the station at Fraternity lodge hall on Washington Street, Salem. Fraternity lodge was fortunate indeed in securing such recognized experts to handle the demonstration for them and the local radio men were in for a radiophone concert right in their own homes that proved interesting. Every amateur station within a radius of fifty miles was able to clearly hear this music and also the voices of the speakers.

A dance was also conducted by the Essex County Radio Association officers recently.

W. E. Dodge, president of the Beverly section was elected treasurer of the County association at the regular executive meeting.

S. Clifford Estey, president of the association, was elected secretary of the County association—both officers will hold two offices for one year.

Something to be Proud of

RADIO NEWS today has the largest circulation of ANY radio publication in any language. Not only that, but it actually has a considerably larger circulation than all of the other nine radio publications COMBINED. With a circulation of 40,000 copies monthly, RADIO NEWS, in point of circulation, text, illustrations and advertising, eclipses every radio publication in print. And all this has been accomplisht in one year.

What will RADIO NEWS be five years hence?

EUREKA RADIO CLUB.

On July 19, the Eureka Radio Club was regularly reorganized. At the meeting, held at the laboratory of Ivan A. Frane, the following officers were elected: Glenn Dorward, president; Paul Rosborough, vice-president; Henry Klaus, secretary-treasurer, and George Burton, librarian.

An instructor in radio theory and practice will be secured as soon as the school season opens.

It is expected to have at least 20 members as soon as the club is well under way. We invite correspondence with radio clubs and amateurs in any part of the country. *The Secretary, Eureka Radio Club, Eureka, Illinois.*

THE PHILADELPHIA RADIO SCHOOL.

The Philadelphia radio school gives a concert between 9:45 and 10 o'clock every night to everybody within range that has a receiving set and wishes to listen. The music is enjoyed regularly by at least 5,000 persons sitting comfortably in their homes, some of them as far away as New Brunswick, N. J. One man in Chestnut Hill made his own receiving set and the outfit, outside of the receivers, cost him about $7.50.

MANCHESTER WIRELESS SOCIETY.

(*Affiliated with the Wireless Society of London*)

The usual weekly meetings were resumed from June 2nd, and many members attended, looking very fit and keen after their holidays. A portable 3-valve receiving set, constructed by a member, was very kindly lent for the evening, and the intricate and delicate interior formed a very suitable subject for discussion. A few members gave details of experiments carried out during the last fortnight, which, for the most part, consisted of reception "stunts," such as receiving European stations on various kinds of frame aerials, including the old familiar bedstead aerial. The most interesting result, however, was the reception of all the well-known stations without aerial or earth wire, using one valve with only 18 volts grid potential. This latter experiment is being very closely followed up, and the effect of an amplifier will be tried, among other circuits: it is expected that some useful work will be done in this respect. Two members mentioned having heard the *Daily Mail* telephony test with great clearness.

The room selected for experiments is open to all members, day and night: by this method inspiration can be put to practical test almost immediately. Particularly are amateurs encouraged in this direction, as experience shows that a keen amateur, given facilities, can compete with some of the more experienced operators.

New members continue to enroll, and it is expected very shortly to establish branches of the Society in outlying districts, and also to form a junior section, in order to encourage the rising generation to take up this wonderful science. An extensive program is being prepared and will shortly be promulgated. Intending members should communicate with the Hon. Secretary, Mr. J. H. Evans, 7 Clitheroe Road, Longsight, Manchester. Correspondence is also invited from other societies and clubs at home and abroad.

RADIO TRAFFIC ASSOCIATION.

At the regular meeting of the Radio Traffic Association, held at Browne's Business College, Brooklyn, N. Y., on June 4, 1920, the following officers were elected: Mr. Walram S. Browne, chairman; Dr. DeWitt L. Parker, 1st vice-chairman; Mr. Joseph LeClair, 2nd vice-chairman; Mr. Frank A. Maher, corresponding secretary; Mr. Albert R. Heydon, recording secretary; Mr. F. William Boettcher, financial secretary; Mr. John P. Holder, treasurer; Mr. Clifford J. Goette, traffic manager; Mr. Ernest K. Seyd, editor *Radio Traffic Bulletin;* Mr. Charles F. Jacobs, associate editor.

The above officers constitute the Board of Directors of the Association to serve a term of one year beginning July 1, 1920.

Our present membership numbers eighty-six, including the majority of foremost amateurs of the Metropolitan district. Amateurs desirous of joining are invited to communicate with the Corresponding Secretary at 4903 Sixth Avenue, Brooklyn, N. Y.

LIVERPOOL WIRELESS ASSOCIATION.

(*Affiliated with the Wireless Society of London.*)

A meeting of the above Association was held at McGhies Café, 58, Whitechapel, Liverpool, on June 9th. As many members are now joining who have had no previous experience in wireless telegraphy, some considerable time was devoted to coaching and assisting the "raw recruits," and it is intended at each meeting to set apart a certain portion of time to dealing with the very elementary stages of wireless for the benefit of new members, in order to make the subject attractive and popular to both old and new members. New members are cordially invited, and should apply to Mr. S. Frith, Hon. Secretary, 6, Cambridge Road, Crosby, Liverpool.

HALIFAX WIRELESS CLUB.

(*Affiliated with the Wireless Society of London.*)

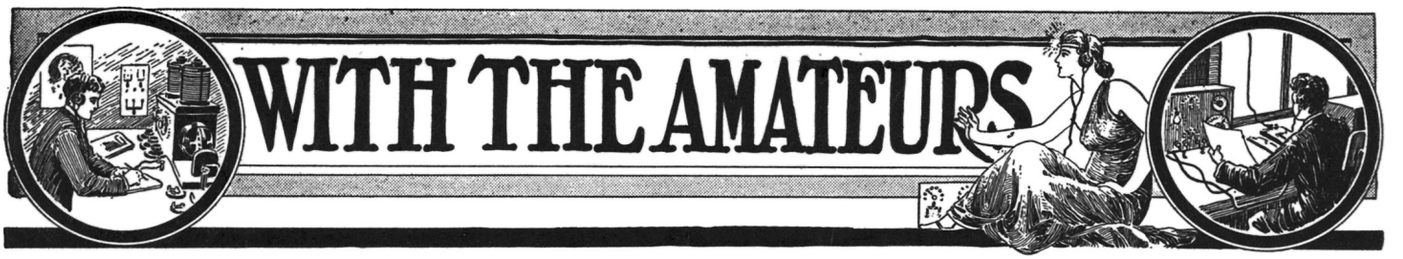
In response to a suggestion from the Halifax Wireless Club, which has its headquarters in the Y. M. C. A., Clare Hall, Halifax, the Chelmsford high-power wireless telephone installation was used to send greetings to Princess Helena Victoria. The occasion was the opening of a Y. M. C. A. Boys' Department, on May 17th, and at three arranged periods the following message was transmitted to the Halifax Wireless Club:—

"To the Halifax Wireless Club.—We, the Marconi's Wireless Telegraph Co., Ltd., send heartiest greetings to Her Highness Princess Helena Victoria, on the occasion of her visit to Halifax to open the Halifax and District Young Men's Christian Association's Boys' Department.

Her Highness has agreed to accept a copy of this message, printed on silk, and the Club is therefore taking the matter in hand at once. The last meeting of the Club was on May 17th, when a paper was read by one of the members on "The Close Alliance that Exists between Magnetism and Electricity."—Hon. Secretary, Mr. L. Pemberton, The Y. M. C. A., Clare Hall, Halifax, England.

FROM THE CLUB GOSSIP EDITOR.

What has happened to the corresponding secretaries of our American clubs and associations? Have they closed shop for the summer or are they canoeing at nearby lakes in the company of their "futures"—lost, as it were in clouds of sublime reveries?



THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

PRIZES: One first monthly prize of $5.00. All other pictures publisht will be paid for at the rate of $2.00.

Radio Station of Miss May L. Smith

First Prize Winner

IT is with pleasure that I present to readers of RADIO NEWS a short description of my station as well as include a photograph of myself seated at the instruments. From this photograph may plainly be seen the essential parts which go toward making my set most effective.

I am located at Manchester, N. H., and I may say that this city (and probably the state as well) has frequently boasted of its pioneer lady radio operator.

I have been interested in Radio Amateurs for several years and as a result, I have graduated from the crystal-detector-tuning-coil stage to my present rather complete radiophone outfit. Of course the station was dismantled during the war but when the order went out to resume operation again, I did not hesitate to start in again with renewed vigor.

Miss Smith Recently Conducted a Very Interesting Radiophone Test Where She Transmitted Music to Many Amateurs Located in Her District. Not a Mean Looking Set, Judging From the Above Photograph Showing Her "Copying" Like a Regular "Opr."

Recently, I conducted a radiophone experiment employing music and conversation with Dr. A. Gale Straw, who is another enthusiast located nearby. In this case we made use of a talking machine and sent out the strains of "The Long Long Trail."

It is needless to say that a great amount of pleasure is expected from the phone set, not only to myself but to my local radio friends as well, who number quite a few.

A general description of my instruments follows:

The aerial, which is of the T type, consists of four wires No. 10 B.S. hard drawn copper, 100 ft. long, spaced 3 ft. apart, 42 ft. high, a 55 ft. lead-in, with a ground 15 ft. in length from the instruments.

The sending set, which is in a case, with glass doors for safety, is made up for a ½ K.W. Transmitter, a Rotary Spark Gap, an Oscillation Transformer and Transmitting Condenser.

I also have a DeForest Type O., A. C. Radio Telephone and Telegraph Oscillion Transmitter, which has given me excellent results.

For receiving, I have the DeForest Type T 100 Differentially Balanced Double Multi-wave Tuner, Type P 300 Combination Audion-Ultraudion and 1-step Amplifier, two Type P 2-step Amplifiers and one 6-volt storage battery with Tungar Rectifier for charging. My receivers are the Holtzer Cabot 3000 ohms type.

I know of no more interesting pastime than Radio. Even with my first set, when NAA was the most distant station to be heard, I found it very interesting, but now, when I have only to put on the long wave coils to get MUU, LMC, POZ and many nearer stations, it is indeed most fascinating and instructive. The Radiophone is proving interesting, especially to those who are not familiar with the code.

MAY L. SMITH,
724 Maple St., Manchester, N. H.

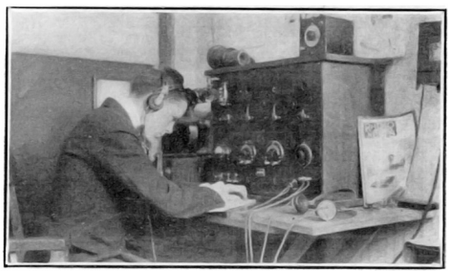
I. R. Groves Station

The above photograph is that of my radio station 2DX operated by myself during any available spare moments. The receiving set consists of several honeycomb inductance coils, an andion detector and 2-step amplifier. The two sets of phones are of the Pickard Navy and Brandes Superiors type, respectively.

The transmitting set consists of a 25,000 volt Thordarson transformer, Dubiler mica condenser, Amrad quenched gap, and oscillation transformer.

No great distance has been accomplisht yet as the sending set is new and I have not had much time to experiment with it.

I have tried out the quenched gap in direct comparison with a good rotary and find the quenched gap far superior. In order to get good results with it, however, it is necessary to carry out the directions of the company manufacturing them.



Quite a Very Good Looking Large Sized Cabinet Which This Amateur Has Installed At His Station.

There is certainly a lot of fun to be had by experimenting with radio. Even during these warm summer days it is sometimes much cooler to "sit in" at the set than it would be to go wandering about in the heat.

Next fall and winter I expect to do a lot of receiving and transmitting work. I am sure I will not be alone in this as there are many thousands of amateurs in the United States who believe as I do.

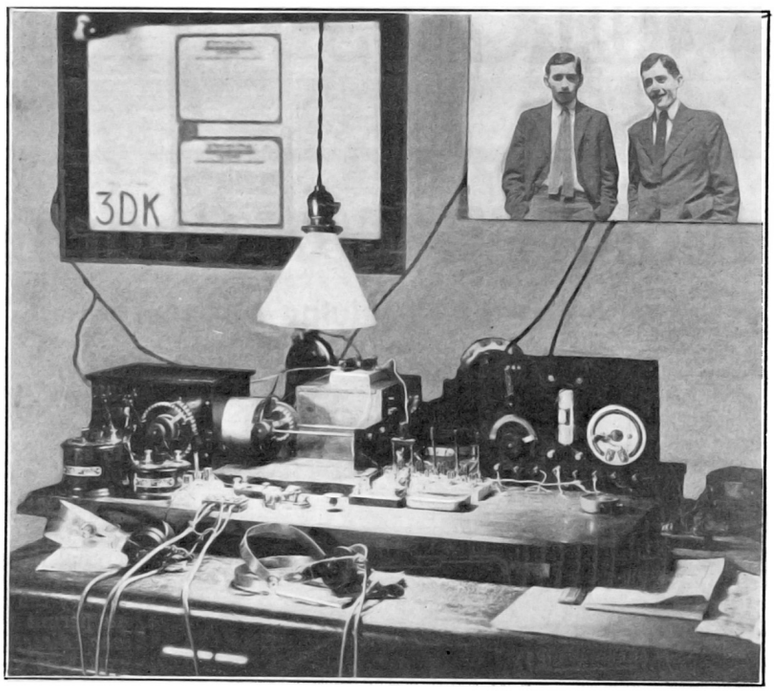
I. R. GROVES,
34 Hobart Ave.,
Summit, N. J.

Station of the Synnestvedt Brothers

THIS is a photo of 3 DK. It is a time exposure taken at night by ordinary electric light. This was necessary because two windows are situated right behind the set.

The sending set consists of the following instruments: Thordarson ¼ K. W. trasformer; home-made glass-plate condenser; Murdock oscillation transformer; Mascot rotary; and Bunnell key, which is mounted on the front of the board. A glimpse may be had of the transmitting set which is on a table behind the receiving set. The condenser is hidden behind the buzzer-test box. The spark gap motor switch is at the right of the board. There are kick-back preventers on the motor and transformer circuits.

The receiving set is comprised of the following instruments: Radio Apparatus Co's Navy coupler; two Murdock variable condensers; a home-designed and home-made audion pannel with rheostat; potentiometer, and audion-ultraudion switch, a Jove crystal detector; Murdock phone condenser; two pairs No. 55 Murdock phones with connection blocks; home-made buzzer-test outfit mounted in box; a portable voltmeter; Eveready storage "A" battery; Wagner rectifier for charging same, and suitable switches for changing aerials, crystal to audion, sending to receiving, etc. The "A" battery and rectifier are mounted in a box on the floor. Extra crystals are kept in a tin box beside the detector. Our station license, operators' licenses, and International Abbreviations are in one frame on the wall. On the table may be seen the U. S. call letter book and a log which we have kept for about a year. We have found it very convenient to have two aerials, a four-wire one sixty feet long for sending, and a one-wire one three hundred feet long and thirty-five feet high for receiving. Two lightning switches are mounted outside the window.

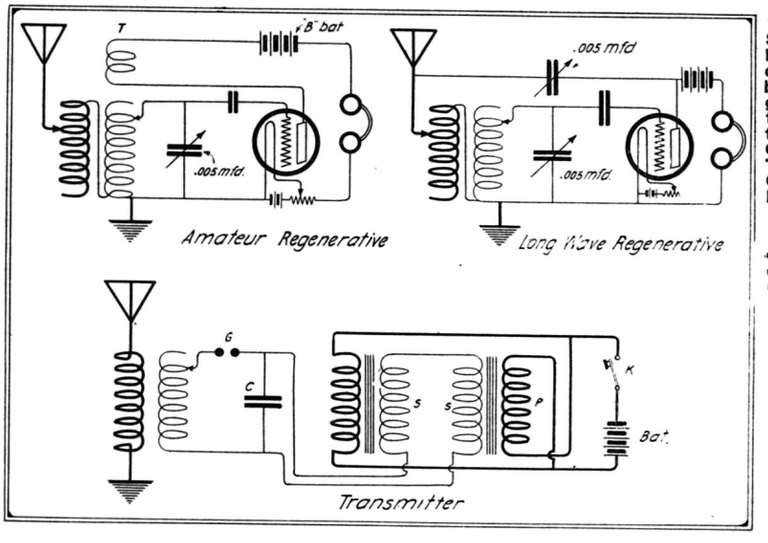


The Synnestvedt Brothers Have Accomplisht Very Good Amateur Results With the Above Well Planned Sending and Receiving Instruments.

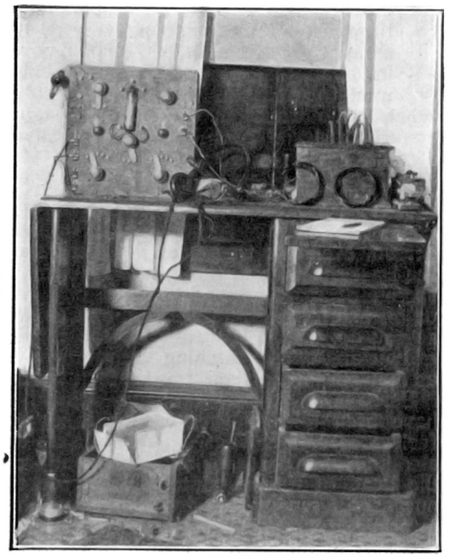
We have done some pretty good long-distance amateur receiving for a single bulb. By our log we have heard over 100 different amateurs in the 3rd district, about 25 in the 1st, over 25 in the 2nd, 1 in the 4th, 1 in the 5th, over 40 in the 8th, and 3 or 4 in the 9th. We use the long aerial to receive amateurs but tune in an original (?) manner. We will let any amateur know how we do it if he will drop us a card. We, like hundreds of other amateurs, were much interested in the tests conducted by 2XJ and KQO and took part in the fading tests. Would like to say in closing that we take considerable interest in the "With The Amateurs" department of Radio News. R. H. SYNNESTVEDT and K. P. SYNNESTVEDT,

Bryn Athyn, Pennsylvania.

Walter Luettgens Station



To the Left Is Shown the Two Receiving Circuits Employed by Mr. Luettgens at His Station, As Well As the Transmitter Circuit Using Two Spark Coils. The Vibrators Are Not Shown.



Why Not Employ An Old Desk, or For That Matter a New One, and Use It For Operating Purposes. This Amateur Finds It Very Convenient As May Be Seen From the Photograph.

This is a photograph of my radio station, located at Manchester, Conn; official call 1UAD.

The panel at the left contains a short wave regenerative set which operates over a range of 175 to 350 meters. This panel also contains inductances for 600 meter stations and three other long wave coils, the wavelength limit of the largest being approximately 20,000 meters. The hook-up used is somewhat unusual, as will be seen from the accompaying diagrams. On the short wave set amateurs in the middle west and south are easily readable.

By including the diagrams of the hook-ups employed at my stations, I thought I would depart from the usual customs practised by other contributors to Radio News "With the Amateurs" page. Altho my circuits may not be strikingly new, other amateurs may wish to try them out, particularly in view of the very good results I have secured by their use. Incidentally it would not be a bad idea for other contributors to do likewise, as no doubt some of them have devised very desirable circuits from the amateur point of view.

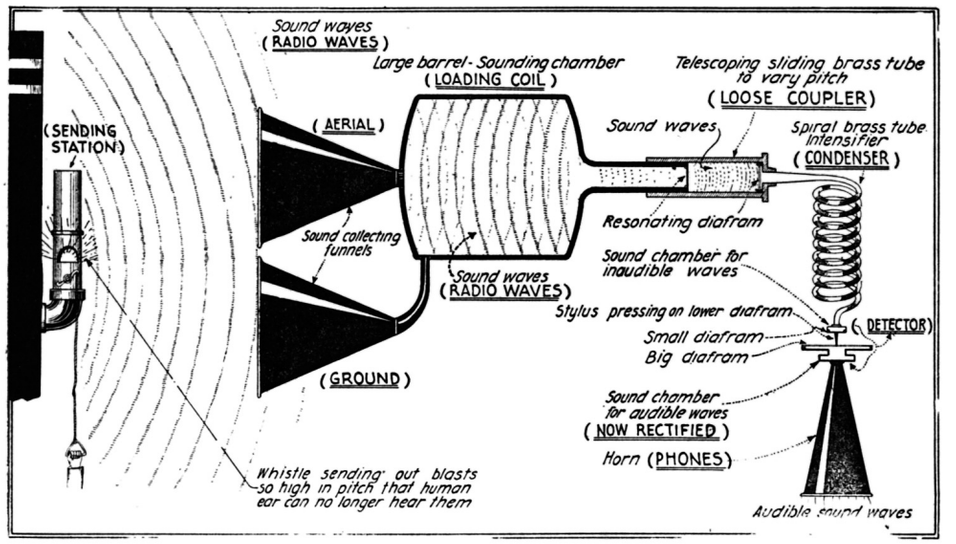
Many commercial stations are heard, NAH1 being readable about 15 ft. from the phones. MUU, YN, POZ, IDO, NSS, NAA, NDD, and LCM come in loud enough to copy with the phones on the table, and I am using but one bulb.

The transmitter consists of two "Flivver" coils, the primaries in parallel, and secondaries in series. A glass plate condenser of three plates, a small quenched spark gap and an oscillation transformer constructed of copper tubing completes the set.

WALTER LUETTGENS,
913 Main St., South Manchester, Conn.

Junior Radio Course

The Use of Receiving Apparatus



This Drawing Is to Show You What Is Supposed to Take Place When Radio Waves Are Sent Out by a Sending Station and Received by a Receiving Station. Study This Air Analogy Closely For It Is Almost An Exact Duplicate of What Would Take Place in the Case of Radio Waves.

IN order that we may better understand the reason for the use of every part of a radio receiving set, we shall describe in detail just what each instrument is used for and how it is supposed to act when radio waves in the form of signals strike the aerial of a particular receiving station.

THE RECEIVING AERIAL*.

It is easy enough to understand the purpose of the aerial. As soon as the ordinary person, even one that does not understand the least thing about radio, sees the familiar spread of mast and wires on a city roof or on a lot, he knows at once, and as well as you do, that it is meant for the purpose of "picking-up" or catching the radio waves as they pass by in their travels thru the air.

Perhaps in school you have studied or have been told by the teacher about the feelers of certain bugs. These feelers are also known as *antennae* and reach out from the head of the bug into the air for the purpose of sensing nearby doings and thus inform the bug of any possible danger. It is a sort of an alarm system. In radio the antenna does the same thing, that is, it senses what is going on in the ether of that particular vicinity.

In a radio receiving set, therefore, the aerial is spread out into a free space of the air so that it may "pick-up" and absorb a certain amount of the electro-magnetic wave energy which has been transmitted or shot out into the air by the distant sending station. In other words, these electro-magnetic waves are said to induce oscillations of radio frequency.

The next step is to make use of the energy picked-up by the aerial so that it will operate some kind of receiving instrument. Generally speaking, the larger the aerial is the larger will be the amount of energy picked-up for any given wave length. You have already been told the difference between short and long wave lengths so do not confuse the two. The longer the aerial the better it will be able to pick-up wave lengths transmitted by *long wave stations.* The shorter the aerial the better will be its ability to pick-up *short wave lengths.*

In either of these cases it is necessary that the *capacity* of the aerial be sufficiently great so that it will pick-up the required energy. By this we mean that the wires stretched out between the two poles or masts be *of sufficient number* as well as of sufficient size. There is of course a practical limit to the capacity of an aerial and they are seldom composed of more than four wires.

STATION INSTRUMENTS.

In the first days of radio the received energy was picked-up and made to operate a receiving device which could be heard plainly within the room. This was called the coherer of which we will have more to say later on. This instrument, however, required a considerable amount of energy before it would respond to the incoming waves and for that reason could only be used for very short distances.

The use of the crystal detector and telephone receiver, however, considerably increased the receiving distance. The telephone receiver is probably one of the most sensitive and yet practical instruments used in the receiving system. In this case the small amount of received current makes itself known by vibrating the diaphragm of the telephone receiver. However, the frequency (the speed of vibration) of a radio oscillation current is ordinarily too high to enable the diaphragm to follow it. That is to say, the effect is the same as if the diaphragm tried to go both ways at once with the result that no motion takes place at all, and consequently gives off no sound.

In order to overcome this difficulty a crystal detector is placed in the telephone circuit. The duty of this detector is to rectify the high frequency oscillations so as to permit *the electrical current to flow in one direction only.* Therefore, when a series of signals are received by the aerial they have the shape shown in Fig. 1. That is, they are composed of groups of oscillations which oscillate back and forth from positive to negative polarity. After they have passed through the tuning inductances they reach the rectifying detector where one-half of their form is separated as shown in Fig. 2. This will be either the positive (+) or the negative (—) polarity. In our case, and for the purpose of illustration, we assume that the remaining half portion is positive (+). This current is, therefore, in reality a direct current *of a pulsating nature* and really assumes the shape shown in Fig. 3. This current is the one that makes the telephone receivers respond by vibrating the diaphragm at each pulse.

The speed at which the diaphragm is drawn up and released depends upon the *frequency* of the incoming wave. *The number of such pulls per second is equal to the number of wave trains per second.* With a 200-meter wave having 1,000 wave trains per second, the radio frequency is about one million and the audio (audible) frequency, one thousand.

The human ear is only able to respond to about 18,000 sound waves (vibrations) per second, so that even if the telephone diaphragm could follow the comparatively high radio frequency vibrations, the ear would not hear the signals anyway. That

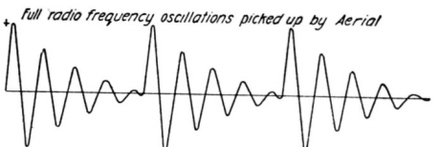


Fig. 1

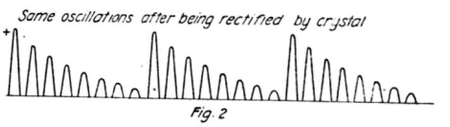


Fig. 2

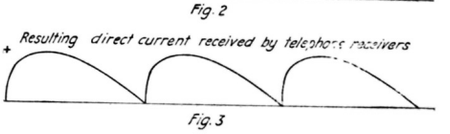


Fig. 3

The Above Figures Show the Three Stages Through Which Radio Waves Undergo From the Time They Are Picked Up by the Aerial Until They Are Received by the Telephone Receivers.

* Carefully read the article on aerials which appeared in the July issue of RADIO NEWS on pages 18 and 19.

is the reason, therefore, for first rectifying the signals, in other words, breaking up their speed so that they will be heard by the ear.

In radio signals both the dot and the dash of the Continental Morse code last long enough to retain many wave groups so that in the telephone receivers the pitch heard by the operator always corresponds to the *spark frequency* of the distant transmitter.

GENERAL PRINCIPLES.

Modern receiving circuits are said to consist of two general classes. Those which are used for dampt waves produced by the spark method, and those used for undampt waves which are produced by the arc, vacuum tubes, or alternator transmitters.

Of course the dampt wave receiving sets are the ones having the most simple connections and are, therefore, easier to understand. However, and as will be explained later when we study undampt wave circuits, it is sometimes a very simple matter to change a dampt wave set so that it will also receive undampt waves as well.

Dampt waves, or those produced by the spark method of transmission, may be received by means of a crystal detector or a vacuum tube detector in connection, of course, with a telephone receiver. As we have seen, the tone heard in the telephones is the same as that of the groups of dampt waves.

The most important principle involved in the reception of signals, and the one that should be ever foremost in the minds of the student, is that which is known as *resonance. This means that for proper receiving conditions a receiving set must be tuned so that it will oscillate at the same natural frequency as the incoming waves.* This, naturally enough, brings us back to our lesson of last month where we explained the use of inductance and capacity; in other words, the use of the tuning coil and the tuning condenser.

THE COMPLETE RECEIVING CIRCUIT.

Fig. 4 shows a typical and complete receiving circuit employing a crystal detector. Although the vacuum tube is a very popular detector at the present day, we shall not concern ourselves with it until we have studied its action in a future lesson. We, therefore, confine ourselves to the good old-fashioned crystal rectifying detector which the greater part of our amateur friends employ.

As a matter of fact the detector, although it is called as such, does not really *detect* the signals. As previously explained, it merely *alters the form of the waves* so that the telephone receivers *can* detect them.

Altho the above circuit is by no means a complicated one, there are still simpler circuits employing still less apparatus than those shown above. In other words, three pieces of apparatus consisting of (1) a telephone receiver, (2) a crystal rectifier and (3) a tuning coil are all that is necessary to effectively receive dampt wave signals. However, and in order to secure selectivity, the circuit of Fig. 4 may be used to advantage.

In this circuit the switch S is for the purpose of connecting the aerial to the receiving apparatus, or for the purpose of grounding the antenna during severe electrical storms when the aerial might pick-up sufficient electrical discharges or lightning

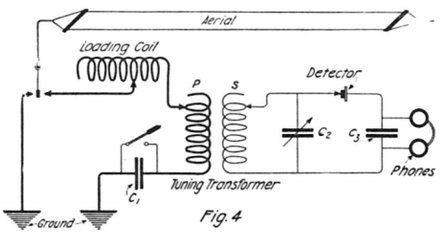


Fig. 4

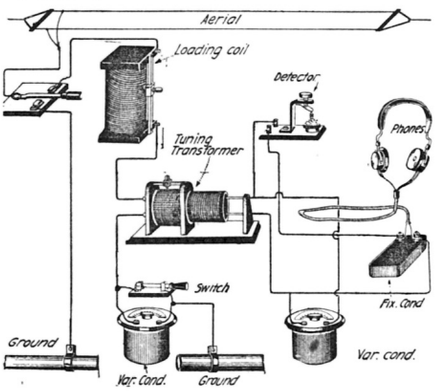


Fig. 4—The Upper Diagram Is the Wiring Circuit of An Amateur Receiving Set. The Lower Sketch Shows the Actual Instruments Which Are Used and Connected Up In the Same Manner as That of the Above Circuit.

to injure the apparatus or even seriously harm the operator. LC is a loading coil designed to increase or add inductance to the loose coupler or tuning transformer when it is desired to receive exceptionally long waves. C1, as previously explained, is for the purpose of decreasing the wave length when necessary. C2 is for the purpose of tuning the secondary circuit in resonance with the primary circuit. The purpose and action of detector D and telephone receiver P has previously been explained to you.

SUMMARY OF ACTION TAKING PLACE IN A RECEIVING CIRCUIT.

As soon as oscillations flow into the receiving aerial, a current passes thru the loading coil to the primary of the transformer where a magnetic field cuts thru the turns of the secondary thus producing a radio frequency current which is gradually built up in amplitude by placing the primary and secondary in electrical resonance. A variable condenser C2 permits the secondary circuit to be adjusted to resonance with the primary circuit as well as allowing close adjustment which the regular secondary inductance multipoint switch is not often capable of doing. If the coupling between the primary and secondary windings is loose, that is to say, quite widely separated, a large amount of capacity and a small amount of inductance will be employed in the secondary circuit so as to secure the loudest signal strength. However, if the coupling between the two windings is close, a small amount of capacity and a large amount of inductance will be necessary in order to secure the loudest signals. When the secondary circuit has been put in resonance with the primary circuit, the induced current will overflow to the detector circuit where it will be rectified by the crystal detector D and stored in condenser C3. As soon as this condenser has accumulated the charge of a single wave train, it will discharge into the telephone P where, as previously explained, it will cause the diaphragm to vibrate at a speed which corresponds to the original spark frequency of the distant transmitter.

In our next lesson we shall take up the study of various forms of detectors.

QUESTIONS FOR THIS LESSON.

1. What is the purpose of the aerial in a receiving set?
2. What is the purpose of the crystal rectifier?
3. How do the radio waves affect the telephone receivers of a receiving set?
4. What is the shape of radio waves before they reach the crystal rectifier? What is their shape after reaching the telephone receivers?
5. What happens in a receiving set as soon as radio waves are picked-up by the aerial? Memorize the complete action.

Dictionary of Technical Terms Used in Radio Telegraphy and Telephony*

Motor Converter—An ordinary induction motor and direct current generator are coupled together on a single bedplate by a common shaft. When the rotor and armature have their E.M.F.'s equal in phase, they are electrically connected so that the two machines act as one. The motor running at half the supply into mechanical energy, which it transmits by the shaft to the converter, while the other half of supply goes to the rotor windings, and thence to the converter in the form of electrical energy. Therefore motor becomes half motor and half transformer, and converter acts as half D.C. generator and half as rotary converter. See Rotary Converter.

Motor Generator—A current transformer consisting of a motor directly coupled by a common shaft to and driving a dynamo.

Multiplier—The hollow coil of wire in which the needle of a Galvanometer is pivoted.

Multiple Tuner—Consists of three adjustable circuits, by means of which a large variety of tunes can be obtained. Aerial Tuning Circuit: A variable condenser placed between a variable aerial inductance and a variable inducing inductance and earth. Is provided with a static leak coil and a micrometer safety spark gap. Intermediate Circuits: Two fixt inductances placed across a variable condenser. Detector Circuit: A fixt inductance in series with a variable condenser and primary of magnetic detector. When on "Stand by," primary of detector is in series with variable aerial inductance, variable condenser and earth. Coupling of the three circuits is varied by moving intermediate inductance coils by means of the Intensifier Handle, placed at the right hand end of the tuner.

Multipolar—Motors and dynamos whose field magnets have more than two poles. See Bi-polar.

Musical Spark—One giving a regular distinct musical note. Produced by a high speed Rotary Discharger, a Quenched Gap, or an Arc.

Muscovite—Another name for Mica. So called because it once came from Russia. It was also known as Muscovy Glass.

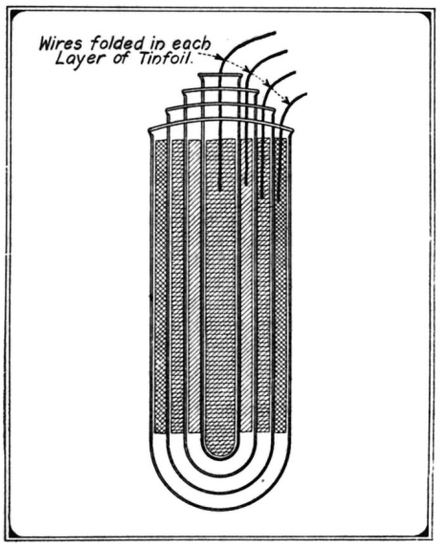
Mutual Inductance—The effect produced by the back induced current of a secondary circuit in the primary circuit is due to their Mutual Inductance. Additional Inductance produced by bringing two inductance coils close together. Number of lines of magnetic flux linked with one circuit due to flow of unit current in other.

(*Continued on page* 112)

* *This Dictionary was started in our March issue.*

Junior Constructor

AN EFFECTIVE AND COMPACT SENDING CONDENSER



By Means of Four Glass Tubes, Bill Johnson Constructed a Novel Condenser Which He Recommends to Others.

Herewith is a way of constructing a cheap, yet efficient, sending condenser which will cost hardly more than 25 cents. It requires four glass test tubes of graduated size and a small amount of tinfoil.

First secure four glass test tubes from a druggist or other supply house, each one a slightly different size. The difference in size should be such that each will slide into one another and leave enough room for two or three layers of tinfoil placed on the outside of each tube, except the largest, or outside, tube.

In the case of the center or smallest of the tubes, the tinfoil is placed inside the hollow part. A wire is then folded or arranged in each layer of tinfoil. This will leave four wires protruding when the instrument is completed.

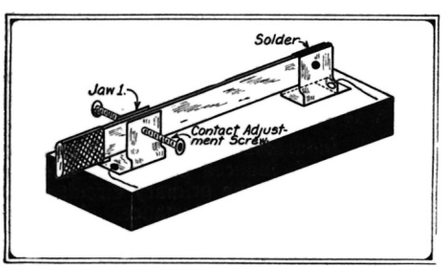
I have personally constructed a number of these novel condensers for my own use, as well as for the use of nearby amateurs, and we find they have proven most efficient.

Contributed by BILL JOHNSON.

AN EASILY MADE DOUBLE SPEED KEY.

This key is made from a S. P. S. T. (single pole single throw) porcelain base knife switch. Its total cost is about 50c.

Close the switch and drill a 1/16-inch hole right thru the center of jaw 1 and the portion of the blade in the jaw. Open the switch and carefully rivet a platinum or silver contact in the small hole in the blade.



The "Wig-Wag" Key Which Can Be Readily Constructed for Amateur Use by Re-arranging a Single-Pole Single-Throw Switch for the Purpose.

Now spread the sides of jaw 1 about ½ inch apart, enlargen both holes, and tap for any size screw that has a platinum or silver contact in one end. These screws are of the type used on spark coil vibrators and are easily obtained.

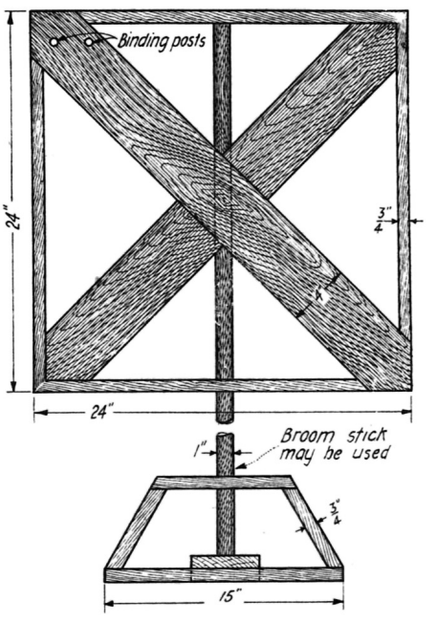
Now close the switch again, and solder the blade to the jaw on which it is pivoted, as shown. Adjust the screws till there is a 1/32-inch air space on either side of the blade contact.

Contact is made by pushing the knob either way in a sidewise motion. It takes a little while to get the knack of these keys, but with a little practise, speeds up to 30 words a minute can be obtained. The use of this type of key also prevents "operators' cramp." It is often called the "wig wag" or double speed key and its operation sounds like that of a socalled "bug" or *vibroplex key.*

Contributed by ROBERT HERTZBERG.

A USEFUL LOOP ANTENNA.

The following device, if properly made, will prove to be a great help to the amateur experimenter:



Secure a Few Pieces of Well-Seasoned Hard Wood and Build Yourself a Useful Loop Antenna as Mr. Weiss Has Done.

This antenna can be used primarily as a direction-finder by simply turning the frame until the distant station can be heard the loudest. Incidentally, amateurs will find this sort of loop antenna very easy to move, and it can be taken in the automobile with a portable set when you go camping.

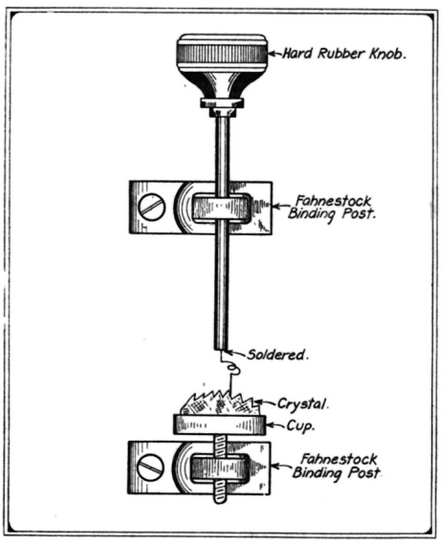
First, get some boards 3 x ¾ for the stand, and some 4 x ¾ for the frame. All measurements are given on the diagram. By following the drawing it will be easy to assemble it. After it is assembled it is stained. Then apply one or two coats of varnish.

The winding consists of twenty-five turns of No. 18, single cotton-covered wire. Binding posts are attached to both ends of the wire in a convenient manner for connection purposes.

After the wire and binding posts are on, give it one more coat of shellac to hold the wire in place.

Contributed by CARLYLE WEISS.

PANEL TYPE "FAHNESTOCK" DETECTOR.



Two Fahnestock Spring Bindings and Several "Knick-Knacks" and You Have a Good-Looking Panel Type Detector.

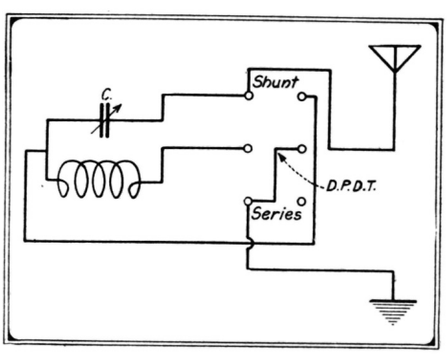
The following suggestion may prove of aid to experimenters who make their own sets. I have in mind a crystal detector which is simple in construction and "stays put." It is made by screwing two "Fahnestock" spring binding posts (may be taken from a Columbia dry battery) about two inches apart on a panel or base. A piece of phosphor bronze wire is soldered to one end of a two-inch piece of No. 8 B. & S. brass wire. The other end is threaded with an 8/32 die to take a hard rubber knob. The catwhisker rod is first passed thru the top binding post before screwing on the knob. A brass cup, taken from a battery carbon, is fitted to the lower binding post.

Contributed by JOSEPH LIEBOWITZ.

SERIES-MULTIPLE SWITCHING ARRANGEMENT

The accompanying drawing describes a series-multiple switch for placing a condenser either in series or multiple with the primary coil. A double-pole-double throw switch is required. A strap is soldered from the aerial lead on the switch to the center lever, as shown. When in series this is not used, but takes place of third switch when it is thrown in multiple.

Contributed by RAY C. STANFORD.



In This Hook-Up a Double-Pole Double-Throw Switch Affords a Rapid Means of Placing the Receiving Condenser Either in Series or in Parallel With the Aerial and Primary of Loose Coupler.

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you make your letter as brief as possible.

CONDENSERS AND CHOKE COILS OF DANNALS RADIOPHONE SET.

(191) Henry Kulikowski, Ansonia, Conn., writes:

Q. 1. Concerning the radiophone set which appeared on page 689, of the June RADIO AMATEUR NEWS, what should the capacity of condenser C_1 be?

A. 1. As the author states the capacity of C_1, which is the feed-back condenser, should preferably be .002 mfd., altho the author uses .005 mfd. Since they are variable, you may easily secure the capacity necessary for your circuit.

Q. 2. I have a Murdock .005 and a De Forest No. C. V.-500 condenser and have no use for them at present. Could I use one of these condensers for C_2 of the circuits shown?

A. 2. You may use a condenser having a capacity as low as .005 mfd. altho the one used by Mr. Dannals is .001 mfd.

Q. 3. Where may I purchase the necessary choke coils mentioned?

A. 3. We suggest that you write to the Pacent Electric Co., 150 Nassau Street, New York City. Why don't you construct them yourself? It is a simple matter and the author gives the proper dimensions.

ADDRESS OF B. J. FIRTH.

(192) A. I., 130 Harrison Avenue, Brooklyn, N. Y., writes:

Q. 1. In the May issue of R. A. N., under the "I-Want-To-Know Column," appeared the name of B. J. Firth, Newark, N. J. I have been trying to locate Mr. Firth for the past three years. Have you a record of his address?

A. 1. The street address was not given. If Mr. Firth or anyone acquainted with him should read these lines, it is suggested that he inform A. J. of Mr. Firth's present address.

SECURING A SPECIAL AMATEUR LICENSE.

(193) The Radio Research Club, New York City, asks:

Q. 1. Can a radio club obtain a special license for 300 meter work and also a separate call under the name of the club?

A. 1. We suggest that you write to the Chief Radio Inspector, Room 603, Customs House, New York. This officer has full jurisdiction over your district and will give you the proper information.

ESSENTIALS OF THE EDISON STORAGE CELL.

(194) L. Jackson, St. Louis, Mo., wishes to know.

Q. 1. How does the Edison storage cell differ from the regular lead accumulator?

A. 1. The Edison cell differs in that the positive plate consists of small steel tubes filled with alternate layers of nickel hydrate mixed with flake nickel, while the negative plate consists of pockets filled with iron oxide to which has been added a small percentage of metallic mercury. The electrolite of the Edison cell is 21% potassium hydrate to which has been added a small amount of lithium hydrate. The Edison cell gives a voltage of 1.2 as compared to the two-volt potential of the lead type accumulator.

Q. 2. Please give a simple way of determining the polarity of a D.C. lighting circuit so that no mistake be made when charging storage batteries.

A. 2. The polarity of a D.C. lighting circuit may readily be determined by immersing the two ends of the circuit in a glass of water to which has been added a pinch of salt. Small bubbles of hydrogen will collect on the *negative* wire. Be sure, however, not to let the two wires to come into contact, otherwise the circuit fuse will blow out.

That "Portable Radio" Prize Contest

Concerning our $100 *"Portable Radio" prize contest which was fully announced in our May and July issues, so many entries have been received, that the work entailed in picking out the winners has been slightly delayed.*

The prize winners, however, will be announced in the September issue of RADIO NEWS. *This number will also contain full description of the First Prize Winner. Look for this important issue.*

BATTERY MOTOR SUITABLE FOR SPARK COIL ROTARY.

(195) H. C. Tetley, Brooklyn, N. Y., writes:

Q. 1. In the article entitled "A Synchronized Commutator Spark Coil Set," on page 16 of the July issue of RADIO NEWS as mentioned, a small six volt battery motor is necessary. Where can I buy such a motor and what is the approximate price of same?

A. 1. A small motor suitable for this apparatus which will run on from one to six volts either dry cell or storage battery may be bought from the Knapp Electric Co., New York City.

FADING SIGNALS.

(196) A. M. Young, Drifton, Pa., asks the following:

Q. 1. Concerning the article entitled "Fading Signals," in the May issue of RADIO AMATEUR NEWS, is there no possible way to overcome this annoying phenomenon?

A. 1. There is at present no method for overcoming fading signals when these are due to natural causes and not to any particular fault of the receiving apparatus or position of the aerial.

Q. 2. Would coal, rocks or mineral deposits in adjacent hills affect reception?

A. 2. Mineral deposits in the vicinity of a radio station particularly if these substances are located in hills or mountains near the station will cause poor receiving and transmitting efficiency of a permanent nature rather than bear a relation to fading signals.

Concerning the interesting phenomena of "Fading Signals," radio engineers at the Bureau of Standards, Washington, D. C., have done considerable work along this line of late and it is expected that the result of their reseaches will soon be publisht.

USING A. C. FOR B VOLTAGE.

(197) Elmo S. Roberts, New York City, asks:

Q. 1. Can A. C. stept-up by means of a small transformer be used in place of a "B" battery?

A. 1. No, not directly, it must be rectified into a direct current. An article on this subject will appear in the September issue of RADIO NEWS.

ENGLISH AMATEURS PURCHASING AMERICAN APPARATUS FROM UNITED STATES.

(198) H. A. Woodyer, Stockport, Eng., asks:

Q. 1. Are there any restrictions against the export of radio supplies from American manufacturers to English importers holding the Postmaster General's radio receiving licenses?

A. 1. No, as far as we know there are no restrictions against this practise. In fact American radio supply houses are receiving orders from English customers regularly.

Q. 2. What is wavelength of a three wire aerial of the inverted "L" type, each wire 35 feet long, 35 feet high with a 12-foot lead-in composed of No. 14 copper wire?

A. 2. The approximate fundamental wavelength of the aerial you describe is 140 meters.

DETERMINING SPARK COIL VOLTAGES.

(199) J. Phillips of Chicago, Ill., writes:

Q. 1. Please publish in your "I-Want-To-Know" columns a simple method for measuring spark coil voltages.

A. 1. The following is a brief table showing the approximate spark voltages in ordinary air between two brass balls two centimeters in diameter:

Spark Length in Cm.	Spark Voltage.
0.1	4,700
0.2	8,100
0.3	11,400
0.4	14,500

(*Continued on page* 121)

"They All Flop Sooner or Later"*
or
It's A Great Game—But Don't Weaken!

THE WIRELESS BUG
HOW IT STARTS
UP GOES THE AERIAL BOYS! BILL SHAKESPERE HAD THE DOPE "STICK TO IT AND GIVE THE WORLD THE RAZZ!
I'LL HOOK UP THAT TREE ANTENNA IF I BUST EVERY BONE IN MY HEAD
WOW! I DIDN'T KNOW THIS WAS A 20,000 VOLT LINE!
I'VE BEEN DOWN HERE AN HOUR AND IF MY WIND HOLDS OUT MY UNDERWATER AERIAL WILL BE A CUCKOO!
THIS UNDERGROUND AERIAL STUFF NEARLY SENT ME WEST, BUT POZ OUGHT TO COME IN LIKE A TON OF BRICK!
IT WORKS! MY NEW RAILROAD WIRELESS IS A BEAR!
UP ALL NIGHT AND ALL SUNDAY LISTENING IN FOR NAA. THIS IS WORSE THAN THE DOGWATCH AT THE BATTLE OF PELHAM BAY!
YOU SAID AN EARFUL BO! RADIO IS GREAT STUFF— I'VE HAD A LOT OF "FUN"

* Inspired by P. Ex. with apologies to R. L. Goldberg

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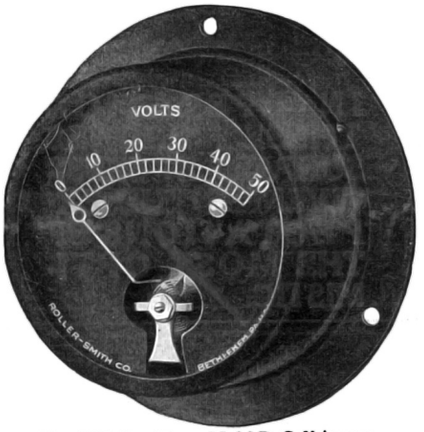

Type TID Base Flange Model D. C. Voltmeter

You need an ammeter, range 0-1.5 amperes, on your receiving panel so as to adjust the filament current to exactly the right value. A voltmeter to match, range 0-50 volts, for the "B" battery is desirable also.

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Printing Arts Press
483 East 24th St. Paterson, N. J.

A Unique Static Eliminator

(*Continued from page 71*)

radio telegraphy. By this we mean that the instrument tunes to the *acoustic* wave and therefore has nothing to do with the electrical circuits of the receiving equipment. Sounds of unlike pitch are naturally of unlike acoustic wavelength and *thus the device offers a method of tuning to any given acoustic wavelength* just as the regular receiving apparatus may be employed to differentiate between radio wavelengths.

Spark signals or continuous waves may be received equally as well. One of the outstanding features of the instrument is that it not only reduces static but reduces to a minimum other forms of interference as well, such as that caused by inter-station. For instance, two stations of nearly the same intensity working on the same radio wavelength cause the individual reception of either to be practically impossible. However, if they are of different spark frequencies and therefore produce slightly different tones in the telephone receivers, the device will enable the operator to differentiate between the two and thus permit either one to be received. In the reception of undampt waves it is generally known that considerable difficulty is often experienced on account of the compensating or back-wave which is caused by the production of beats within audibility. Differentiating between, or concentrating on one of the two notes requires a great deal of practice and an operator must be well trained and experienced in this sort of reception before he is qualified to handle trans-oceanic or any other kind of traffic employing continuous waves. With the use of the present device however, this difficulty is overcome owing to the fact that it entirely eliminates the back wave, leaving nothing but the *pure beat note,* thus rendering the final reception much more distinct. Fig. 1 shows an ordinary short wave generative circuit having two variometers and making use of the signal filter we have just described. As may be seen, the device is connected across A and B where ordinarily would be inserted the regular head-set. An important factor is that since the instrument is not an electrical one no additional batteries are required for its operation.

In conclusion it may be said that the inventor is at the present time developing several improvements and appliances designed to make the present static eliminator absolutely fool-proof and *efficient* so that not only will it prove exceedingly valuable to commercial radio interests but to amateur operating as well. At any rate Mr. Lynch is to be complimented for this interesting development and addition to the radio art. One thing certain the elimination of static and other forms of interference by means of an acoustic weeding-out system would seem to be a step in the right direction.

BUREAU OF STANDARDS DEVELOPING RECEIVERS FOR RADIO WORK.

The United States Bureau of Standards of Washington is conducting a comprehensive study of telephone receivers for radic telegraphy and telephony. The primary object of the research is to determine the best type of receivers, but it is probable that much other useful information will be obtained as regards methods of measuring the strength of signals and the determination of a standard "artificial ear" to which the ears of any observer can be referred.

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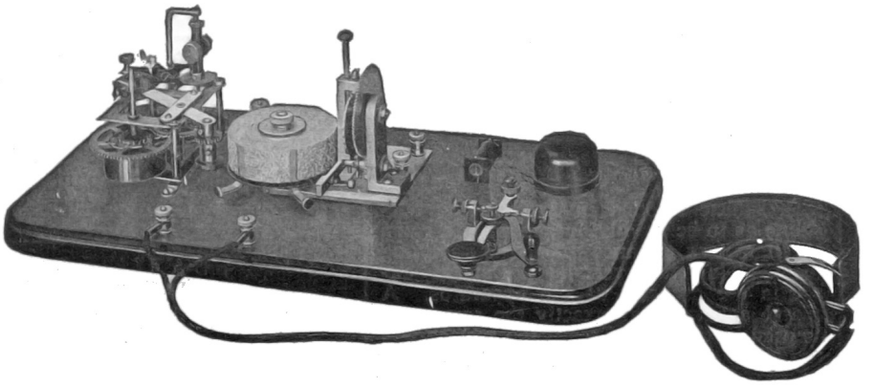

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The Braun Loop Antenna

(*Continued from page 70*)

tains the high frequency amplifier, the plate battery, tuning condenser of the loop circuit and the telephone. Another case contains the accumulator for heating the tube filaments. In fact, the whole can readily be carried in a portfolio, a most desirable factor, indeed.

In Geltow, near Berlin, there has been installed a huge Frame Antenna, comprising two frames of 6 turns and about 28 meters side length, suspended from a wooden mast 40 meters high. One of the frames is tuned for communication with New Brunswick, U. S. A., to the wave length of 13,500 meters, which differs only by 7 per cent of the wave length of the Nauen Station (12,600 meters), and which is situated at a distance of 20 kilometers. In order to increase the receiving capacity of the station, arrangements for communicating with Annapolis (17,000 meters) had to be provided. Inasmuch as this connection had to be perfected in a very short time, the installation of another 40 meter mast was out of the question, but the other frame could be so arranged as to receive the Annapolis wave without any mutual interference. In fact, there is no objection to fitting even further frames on the same mast.

Another somewhat smaller frame antenna installation, which is only 20 meters in height, allows the signals from a number of American stations (New Brunswick, Tuckerton, Arlington, etc.), to be received

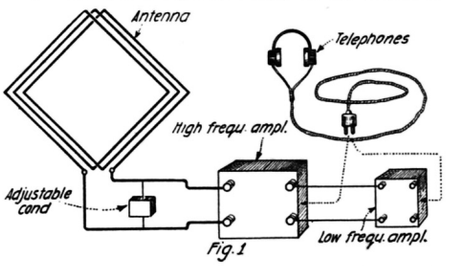


Fig. 1

Schematic Circuit Diagram of Hook-Up Employed With the Braun Loop.

with sufficient sound intensity in the telephone as to be readily overheard in a room at 10 meters distance from the receiving room. This, however, by no means exhausts the capacity of the apparatus. A Morse apparatus of exactly the same type as used in the official telegraph service will record on a strip of paper the signals from an American station working at the high rate of 50 to 70 words per minute, tho the apparatus will function as well at twice this speed, when even the most skilled telegraphers will not be able to receive and copy with the regular telephones. The most astounding achievement, however, no doubt is that telegrams from America are, without any disturbance, thus recorded on paper, *while at the same time the mammoth station of Nauen at only about 20 kilometers distance howls into space,* messages so powerful as to be heard by Australian stations, 20,000 kilometers distant. This freedom from interference, of course, is insured by installing the frame in the most unfavorable direction to Nauen radio and in the most favorable direction for the United States.

Portable loop antennae such as those represented in our illustrations will lend themselves to a multitude of uses. In the railway train and rowing boat, nay even when on a walk, everyone will be able to communicate with distant friends.

The most valuable feature of the Braun antenna is its remarkable *directive effect;* two stations situated at a known distance from one another allowing the position of the sender *and its distance from the receiving stations to be readily ascertained.*

G. A. Standardized Apparatus

G. A. GRID CONDENSER

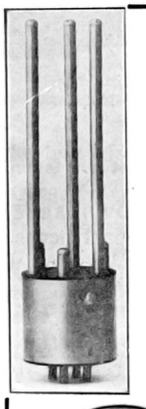
A pure paraffin paper free from chlorine and other blending agents wrapped tightly around a special strip having a high insulation resistance. Between the layers of paraffin paper are two tinfoil plates and from each plate a heavy copper foil extends to and is securely eyeleted to the ends of the insulator strip. A sealed wrapper protects all and adds attractiveness. Very careful selection of material and better workmanship tend to reduce losses to a minimum. Every condenser tested to 0.0005 mfds. capacity.

Price 35c

Postpaid in the U. S. A. 45c.

DEALERS. Let us tell you about a real seller, something that has sold the country over and that is only started to make profits.

The General Apparatus
4310-N Broadway N. Y. C.



AUDIOTRON ADAPTOR

Consists of standard 4 prong base with brass supporting connectors. Permits mounting tube in vertical position so filament will not sag and touch grid.

$1.75 POSTPAID
NEW "VT" SOCKET

$1.00. Marconi Grid Leak (without base) 55c.
Mica-Copper-Foil Grid Condenser, 40c.
We strongly recommend our 44 Volt Variable "B" Battery for use with Detector "VT's", $3.60.
Moorhead Electron Relays, $6.00. (With standard base. See Moorhead adv.)
$10 General Radio Ammeters, $5. (0-2½ amps. for antenna radiation or filament current indication.)

PARAGON RHEOSTAT

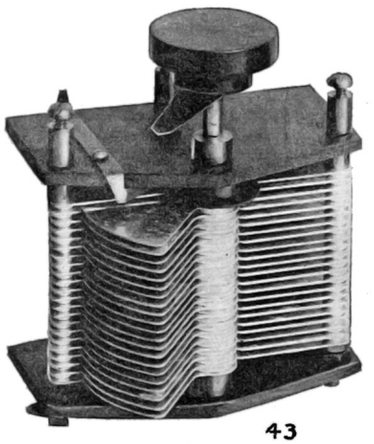
The 6 ohm resistance permits fine filament control with 4 or 6 volts. 2⅛" dia. See March R. A. N., page 467, for details. Shaft reversible for back mounting.

$1.75 POSTPAID

Western Electric P-11 Army-Navy Phones, $12. Special Acme Amplifying Transformers to use with above phones. $4.50 unmounted. With stands, $5.

GROUND WIRE, 8c Per Ft., $7 Per 100 Ft.
Good 100 Amp. 600 V. Lightning Switches, $4.

RADIO EQUIPMENT CO.
630 Washington Street Boston-11, Mass.



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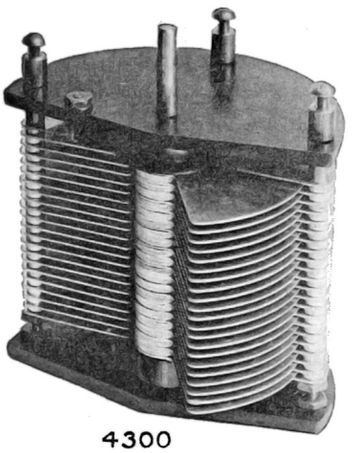


4300

Entire Satisfaction

is what our customers say.

ARE YOU

GETTING ENTIRE SATISFACTION from condensers you have purchased elsewhere?

IF NOT, we are sure you will be pleased with what we are offering, *because,* we manufacture *only* the BEST.

All we ask is GIVE US A TRIAL.

This month we wish to announce a NEW MODEL of VARIABLE CONDENSER, which will be known as SERIES "T". It is of the same general construction as our SERIES "S" condenser, but is built of heavier material, the aluminum plates being die stamped from 1/32" hard rolled stock. The spacers are also of heavier stock, and the general assembly insures a very rigid instrument. At the present time we are unable to fill orders for the SERIES "S" condenser, as we cannot obtain materials, but can ship the NEW SERIES "T" or the SERIES "L" condenser from stock.

PRICES

SERIES "T".

No. 20	2	plate	Vernier.	$2.00
No. 70	7	plate, approx.	.0001 m.f.	$2.35
No. 130	13	" "	.0002 m.f.	$2.75
No. 170	17	" "	.0003 m.f.	$3.15
No. 230	23	" "	.0005 m.f.	$3.60
No. 310	31	" "	.0007 m.f.	$4.30
No. 430	43	" "	.001 m.f.	$5.25
No. 630	63	" "	.0015 m.f.	$7.50

Include postage for one pound to your city.

SERIES "L".

No. 2300	23	plate, .00075	$6.00
No. 4300	43	plate, .0013	$8.00
No. 6300	63	plate, .002	$10.00

Include postage for two pounds.

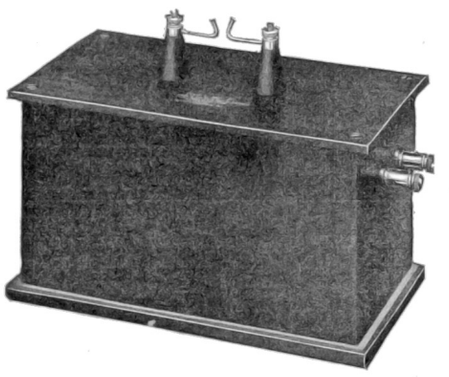
Prices include knob and pointer and mounting screws. Specify whether brass or nickel pointer and screws, and thickness of your panel.

Either style of condenser, fitted with indicating dial at additional cost of 75c.

THE WIRELESS SHOP

511 West Washington St. A. J. EDGCOMB Los Angeles, Cal.

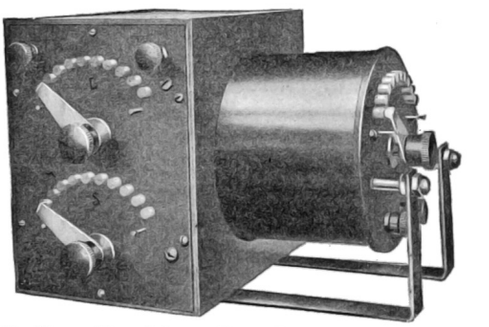
IF MONEY IS NO OBJECT



You want the best your money can buy. Our reputation for reliability during 12 years of manufacture of high grade radio equipment will insure your satisfaction to the smallest detail.

IF YOUR INVESTMENT IN RADIO MUST BE LIMITED

You can even less afford to experiment with unknown products. You will find our apparatus will in every case give you the greatest value for the sum invested.



Radion Receiving Transformer 200-3000 Meters. Price $14.00.

The patented principle on which our Type L High Tension Transformer is constructed places it above comparison for charging the condenser used in radio transmitters.

Power Rating	Maximum Secondary Volts	Required Condenser	Price
¼ K.W.	20,000	.01 M.F.	$23.50
½ K.W.	29,000	.01 M.F.	28.00
1 K.W.	40,000	.01 M.F.	40.00

Complete Catalogs mailed on receipt of 6c stamps.

CLAPP EASTHAM CO., 120 Main St., Cambridge, Mass.

Our Apparatus Carried in Stock by All Good Dealers. ***If Your Dealer Won't Supply You Write to Us.***

RADIO SERVICE

apparatus is designed and built to give you complete satisfaction.

Each piece of apparatus is thoroughly inspected and tested before it leaves our factory, thereby insuring you of a product that will work perfectly.

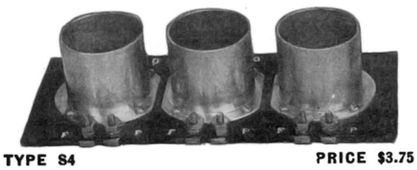
The AUDION CONTROL PANEL as illustrated sells for only $6.50 and operates as well as the more expensive kind, while the material used in its construction is the best obtainable.

The *Radio Service* V. T. Sockets are acknowledged as the best obtainable. The triple tube type is illustrated.

Type S1—Single Tube (for inside mounting).....$1.20
Type S2—Single Tube (for bench and experimental use) 1.50
Type S3—Double Tube (for amplifier use)..... 2.75
Type S4—Triple Tube (for detector and two-stage amplifier or three-stage amplifier use).. 3.75

The above receptacles are all made in two styles, for either receiving or transmitting tubes. This should be specified when ordering.

If your dealer cannot supply you, order direct.



TYPE S4 **PRICE $3.75**

SPECIAL—A Radio Service 3" etched aluminum dial graduated from 0° to 180° for 30 cents postpaid. A limited quantity only on hand.

Grid or Telephone Condensers 35 cents each

RADIO SERVICE & MFG. CO.
LYNBROOK, L. I. NEW YORK

AN OPPORTUNITY

for amateurs to get the benefit of a profit sharing plan.

THE CO-OPERATIVE RADIO ASSOCIATION — with its great wholesale buying power, fills a long felt want in amateur circles. Members get substantial discounts on any advertised instrument or part.

Send your membership fee of ten cents at once and get the benefit of an organization made for amateurs.

Write to

The Co-operative Radio Association

849 Freeman St.
New York City

Attention Beginners!

WILGO WIRELESS PRACTICE SET

The first need of every amateur. Hightone buzzer and key for learning code. Also for test buzzer and four other purposes. With code, and instructions, $1.25 Postpaid.

THE WILCOX LABORATORIES, Lansing, Mich.

Navy Broadcasts For Amateurs

Code Translations for Month of June

[*Ed. Note: Each month an abstract of the amateur code messages sent out by the New York Radio Station NAH will be published in* Radio Amateur News. *The purpose of this is so that amateurs who copy this code may have a means of checking up what they have received and thus know how they are progressing in receiving ability.*]

The following messages were broadcasted in the Amateur Radio Code by Navy Radio Station, New York, N. Y., on 1,500 meter wavelength, during June, 1920:

June 1—Code Two—Following from Boy Scout Headquarters quote Merchant Marine Department American Library Association announces via Navy and Boy Scout Radio Service that it supplies vessels sailing under American flag with books of fiction, travel and nautical instruction. Period boxes contain seventy to eighty books exchangeable at Dispatch offices in large ports. Period please tell local newspapers. Unquote.

June 2—Code Two—Following from Boy Scout Headquarters quote American Library Association announces via Navy and Boy Scout Radio Service that it is raising fund to provide books for merchant sailors comma coast guard comma lightship and lighthouse personnel. Period men who have used "Ala" books can help by writing to newspapers. Unquote.

June 3—Code Eight—High power radio station at Lyons, France, transmits to Navy ships on fourteen thousand meter undampt wave at midnight and twelve thirty PM Greenwich mean time each day.

June 4—Code Ten—Translation of amateur code message sent during May was mailed to the Amateur Radio News June second period these translated copies are available to any one requesting them.

June 5—Code Four—Giant battleship Tennessee placed in commission at New York Navy Yard June third will have one of the most modern radio installations in the United States Navy.

June 7—Code Two—Red Star liner Lapland was first ship to respond to SOS call of SS. Bergensfjord on June fifth nineteen nineteen.

June 8—Code Two—Boy Scouts headquarters report Willam H. Kendrick assistant director of agricultural extension work West Virginia has arranged for Lectures on Radio and scouting at the state meeting of agricultural club boys Morgantown June fourteenth to nineteenth.

June 9—Code six—Recent tests of obtaining radio compass bearings of seaplanes in flights have been highly successful.

June 10—English—It is understood that Boy Scout headquarters Fifth Avenue Building New York City is considering a plan which provides for the opening of a technical department for the purpose of furnishing information for radio amateurs relative to efficient radio installation period when this department is in operation it will answer all correspondence relative to this subject as a courtesy to radio amateurs.

June 11—Code Two—The name of the United States cruiser North Carolina has been changed to Charlotte period call letters "NMN" will be used.

June 12—Code Six—Returns from the Chicago and San Francisco political conventions will be broadcasted by radio on both coasts.

June 13—Code Eight—The Rockaway air station has resumed radio experimental work and will use call letters "C seven L."

June 14—Code Ten—The large Japanese battleship Matsu launched last week at Tokio will have a powerful modern radio installation period call letters not yet assigned.

June 15—Code Two—The former German battleships Ostfriesland and Frankfort will probably arrive at New York next August period arrangements will be made for radio amateurs to visit the ships to inspect the radio equipment.

June 16—Code Four—Following received quote John Newton of Bay Side, Long Island New York comma whose age is fifteen years comma is a radio operator on training ship Newport period Newport will cruise in Mediterranean and South American waters till October unquote.

June 17—English and Code Six—Following received quote on Memorial Day Philadelphia Seascouts dedicated their base training station at Homesburg Pa stop This is the second Seascout training station on the Atlantic coast comma the other being at Bridgeport comma Connecticut stop All scouts report receipt of this message to headquarters Fifth Avenue Building New York unquote.

June 18—Code Two—Name of United States Navy Cruiser Montana has been changed to Missoula period Call leters NKM will be used.

June 19—Code Two—High power radio stations are having difficulty to work across Atlantic because of the unusually heavy static on long waves.

June 20—Code Four—Arrangements are being made to equip Shipping Board ships with arc transmitters to work on twenty four hundred meters.

June 21—Code Eight—Meteorogical reports for British Aeronauts are broadcasted daily by

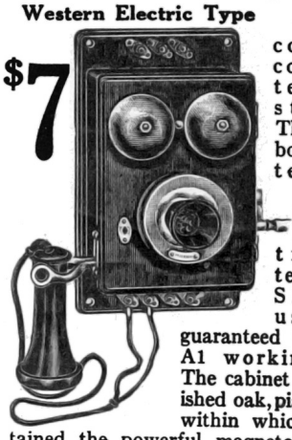
(*Continued on page* 104)

For Homes, Offices, Factories, Farms

Complete Wall Set Magneto Telephone

Western Electric Type

$7



This is a complete commercial telephone station. They were bought from telephone exchanges who put in Central battery types. Slightly used but guaranteed to be in A1 working order. The cabinet is of polished oak, piano finish, within which is contained the powerful magneto, the 300 Ohm polarized ringer, an induction coil. The magneto is exceptionally efficient, being of the two bar type with brass gear transmission. The extra sensitive microphone, mouthpiece and two gongs are mounted on the front of the cabinet, giving the entire instrument that desirable appearance of compactness and efficiency. Guaranteed to work over 20 miles. The telephone receiver is a double poled one, and has a hard rubber case. Seven binding posts are provided for connections.

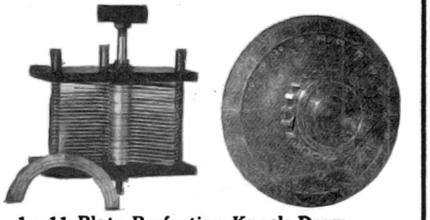
The instrument is one which we can offer with pride to our patrons at a ridiculously low price. It is unobtainable anywhere else at less than $15.00 and is an instrument unequaled in value for the price we ask. Size over all 11x10x8 in.

Long Distance Telephone Set—
One station..... $7.00
Shipping weight, 15 lbs.
Two stations
Shipping weight, 25 lbs..... $13.00

Send 6c in stamps for our big 160 page Wireless and Electrical Catalog No. 22.

THE ELECTRO IMPORTING CO.
231 Fulton Street, New York.

COMBINATION No. 2



1—11 Plate Perfection Knock Down Variable Condenser $1.80
1—No. 67 Corwin Indicating Dial... 1.30

Total value $3.10

Special for August Only, $2.50
and 10 cents postage

Our combination No. 1, published last month met with such general favor among amateurs that we, in consideration of the confidence placed in us, are offering for this month a value which we consider even greater than our former combination, and at the same saving of 60 cents.

Our satisfaction or money back guarantee applies to this offer as well as all goods we sell.

Our firm name is being copied. Make sure when ordering goods from us to look for our "PRACO" trade mark.

PRACO PRACO

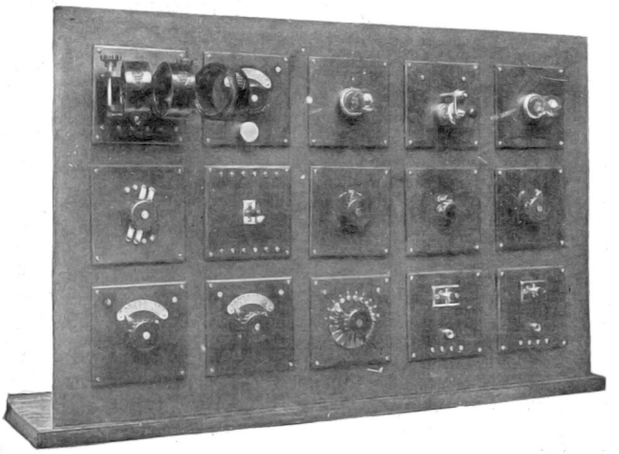
PENN RADIO APPARATUS CO.
Dept. 2 Box 110
Reading, Pa.

DE FOREST

THE typical 15-panel DE FOREST Unit Receiving Set shown below consists of a Tuner with wave length range of 150 to 25,000 meters; a crystal and an audion detector, and a one-step amplifier. This Set is the most complete and efficient receiving apparatus ever put out under $175.00. Its cost is less than that; the entire set of Units shown below totalling only

$162.64

DE FOREST
Unit Receiving Sets
Give You Better Apparatus at Low Cost



Simplicity, Absolute Reliability, Economy and a Broader Radio Knowledge are assured with the DeForest Unit System.

DE FOREST Unit Receiving Sets offer the most practical system of securing accurately designed and highly efficient receiving apparatus without paying for expensive factory assembly and costly cabinets. You buy the individual instruments, ready mounted on Unit panels, and assemble and wire them yourself. You can start with a few Units and then build up, always fitting new Units into the system as additions to the old, to increase your selectivity and circuit efficiency. You can even fit these Units into any system you may now have.

If you are going to take up wireless work, find out about the DeForest Unit Receiving Set before you get your apparatus. It will give you the most highly developed Radio Instruments obtainable. And if you are an Amateur, Student or Experimenter, this Unit System holds even greater possibilities because in using your own ingenuity in assembling and wiring the Units you will greatly broaden your Radio knowledge. There are many possible Unit Set combinations and you should

Send for the De Forest Radio Manual

which describes the Unit System in full and also contains much valuable general Radio material. Send 10 cents for a copy at once.

DE FOREST RADIO TELEPHONE AND TELEGRAPH COMPANY
Inventors and Manufacturers of High Grade Radio Apparatus
1403 SEDGWICK AVE. NEW YORK CITY
Lee De Forest Incorporated, 451 Third St., San Francisco, Cal.
Western Distributors Shipments Made from San Francisco Stock

DE FOREST

RADIO APPARATUS

Distributors of Reliable Radio Apparatus for Schools, Colleges and Experimenters in Every Branch of the Radio Field

"PITTSCO" THE SIGN OF SERVICE AND IMMEDIATE DELIVERIES! ALL WE ASK IS A TRIAL!

REMEMBER! WE CARRY AN IMMENSE STOCK AND CAN MAKE IMMEDIATE DELIVERY ON EVERY ITEM LISTED!

TRANSMITTING TRANSFORMERS
(Latest type)

Acme	250 Watt, unmounted	$13.00
Acme	250 Watt, mounted	16.00
Acme	500 Watt, unmounted	18.00
Acme	500 Watt, mounted	22.00
Acme	1000 Watt, unmounted	28.00
Acme	1000 Watt, mounted	33.00

F. D. PITTS CO., BOSTON, MASS.

TRANSMITTING CONDENSERS
(Dubilier)

Type	Power	Volts	Cap.	Price
D-100	¼ K. W.	10000	.007	$19.00
D-101	½ K. W.	14000	.007	30.00
D-102	1 K. W.	21000	.007	45.00
D-103	1 K.W.	25000	.007	50.00
D-150.		8000	.0024	5.00

Suitable for spark coils.

AM-888 Line Protector 4.00

F. D. PITTS CO., BOSTON, MASS.

SPARK-GAPS

Amrad Type G-1 1 K. W.	$29.75
Amrad Type G-2 ½ K. W.	18.75
Amrad Type G-3 ¼ K. W.	13.50
Benwood Rotary Quenched	30.00
Hayward-Little Wonder. Any tone, runs on 6 volts or 110 transformed AC or DC	12.50

F. D. PITTS CO., BOSTON, MASS.

PITTSCO

OSCILLATION TRANSFORMERS

No. Y-200 Clapp Eastham, large, for ½ K. W. and up	$20.00
No. TXL-101-A International	16.75
No. Y-100 Clapp Eastham up to ½ K. W.	14.00
No. 424 Murdock	5.00

F. D. PITTS CO., BOSTON, MASS.

CONTINUOUS WAVE POWER TRANSFORMERS
(For Wireless Telephone Work)

Acme	50 Watt, mounted	$15.00
Acme	50 Watt, unmounted	12.00
Acme	200 Watt, mounted	20.00
Acme	200 Watt, unmounted	16.00

F. D. PITTS CO., BOSTON, MASS.

MODULATION TRANSFORMERS
(For Wireless Telephone)

Acme A-3, unmounted	$4.50
Acme A-3, semi-mounted	5.00
Acme A-3, mounted	7.00

F. D. PITTS CO., BOSTON, MASS.

HONEY-COMB COILS

LITZENDRAHT WIRE.		(While they last.)
LL-75	330-1030 meters	$1.60
LL-100	450-1460 "	1.70
LL-150	660-2200 "	2.00
LL-200	930-2850 "	2.10
LL-250	1300-4000 "	2.30
LL-300	1550-4800 "	2.50
LL-400	2050-6300 "	2.80
LL-600	4000-12000 "	3.00
LL-750	5000-15000 "	3.20
LL-1000	6200-19000 "	3.50
LL-1250	7000-21000 "	3.90

Note:—These are the genuine De Forest litz coils.

F. D. PITTS CO., BOSTON, MASS.

TELEPHONES (Pair)

No. 1 Type C Baldwins, standard Navy type	$16.50
No. 2 Type E Baldwins, new type, smaller	18.50
Brandes, "Superior" 2000 ohms	7.00
Brandes, "Transatlantic" 2800 ohms	10.00
Brandes, "Navy type" 3200 ohms	14.00
No. 55 Murdock, 2000 ohms	4.50
No. 55 Murdock, 3000 ohms	5.50

F. D. PITTS CO., BOSTON, MASS.

IMPORTANT! Every article listed sent to any part of the United States. Postage or express prepaid.
We want your business!
Series No. 5 (Keep this ad and watch for next month's)

Send 6 cents in stamps for new catalog!

F. D. PITTS CO., Inc.
12 Park Square Dept. C. Boston, Mass., U. S. A.

Stromberg-Carlson Radio Head Sets

Equipped with Non-conducting spool heads and slotted pole tips which eliminate eddy current losses.

All operating parts of the Stromberg-Carlson Radio Head sets are housed in dust-proof and moisture-proof aluminum cases. Diaphragm is mounted metal-to-metal. Temperature variation will not disturb the airgap adjustments. Each set is wound to a resistance of 2,000 ohms with pure copper wire and furnished complete with 6-foot moisture-proof cord attached. This set, while it is constructed strong and durable, is very sensitive. For use ashore or aboard ship.

A sample set will be sent upon receipt of $12. Try it in your own station for private and commercial Radio Service. Money refunded if not satisfied.

Bulletin 1606 Gives Full Particulars. Write

STROMBERG-CARLSON TELEPHONE MFG. CO.
Rochester, N. Y., U. S. A.

Q S T de ACE

LET'S SING

(TUNE: *Battle Hymn of the Republic*)

Mine ears have heard the signals
From a dozen different lands
From Greenland's icy mountains
To Sahara's burning sands
From the land of cherry blossoms
To where Mount Sorata stands.
And I've learned a thing or two.

CHORUS

Q. R. X. I'm going to tell you
Q. R. X. I'm going to tell you
Q. R. X. I'm going to tell you
How you can get them too.

This spasm continued next month. Watch our ads, they are "different". So are our instruments. It's to our mutual advantage to get acquainted. "You may pay more, but you can't buy better."

DEALERS. If you don't stock Ace equipment you are missing a good line.

THE PRECISION EQUIPMENT COMPANY
2437 Gilbert Ave. Dept. A Cincinnati, Ohio.

"YOU RADIO ENTHUSIASTS"

Add This List to the One We Gave You Last Month:

PANCAKE HELIX, $2.70; SIGNAL TYPE, $5.00. OSCILLATION TRANSFORMERS, $5.00 up.
ARLINGTON RECEIVING TRANSFORMERS, $11.40; JR. size, $6.00; others, $22.00 up.
SPARK COILS, ¼" $4.50; ½" $5.50; ¾" $7.48; 1½" $11.00; others.
QUENCHED GAPS, $17.00 and $10.00. COIL AND GAP COMBINATION, $33.50.
"B" BATTERIES, Standard and Cyclone Types, large size, **$2.20;** small, **$1.00.**
EVEREADY "B" BATTERIES, $3.25; VARIABLE "B" BATTERIES, $3.25.
ANTENNA SWITCHES, $4.50, $5.60, $9.25; SMALL KNIFE SWITCHES, 30c, 80c, $1.10.
SPECIAL CARBON GRAIN TRANSMITTERS, $3.00; SINGLE RECEIVERS $1.75.
SPECIAL SENDING SET COMPLETE, just attach plug to your elec. socket, **$18.00.**
PRACTICE SET includes **BUZZER AND KEY, $2.70;** others at **$3.25.**
SENDING CONDENSERS, $1.75, these have photo plates, good for any spark coil.
BAKELITE cut to order, **$2.00** per lb. **HARD RUBBER, $1.50** per lb.
WIRE, all kinds, list in catalog, send **10c** for it.
MEMBERS OF THE RADIO CLUBS RECEIVE A DISCOUNT ON ALL PARTS AND APPARATUS.

AMERICAN ELECTRO TECHNICAL APPLIANCE COMPANY, 235 Fulton St., N. Y. C. Dept. R

(*Continued from page* 102)

British Air Ministry Station comma call letters GFA comma on fourteen hundred meters and by Aberdeen comma call letters BYD comma on thirty three hundred meters.

June 22—English—All amateurs are requested to stand by Wednesday June twenty third for important test stop message from Honorable E T Meredith Secretary of Agriculture will be transmitted with request to deliver it to local Boy Scout Headquarters for distribution to newspapers and points in public places stop Navy Radio New York will broadcast this message on fifteen hundred meter spark set nine thirty P M seventy fifth meredian time June twenty third.

June 23—English—Following from Secretary Agriculture via National Headquarters Boy Scouts of America quote amateurs please rush this message to local Boy Scout headquarters stop Please rush to newspaper offices also post in public places also report to National headquarters New York period Message from Secretary Meredith Department of Agriculture to Boys of America comma America needs your help in food production in gardens and on farms stop. You can do your country no better service than to show now through your efforts your ability to become productive citizens unquote.

June 24—Code Ten—Paris Academy of Sciences has offered prize of twenty thousand dollars to person who finds a way to communicate with the inhabitants of another planet.

June 25—Code Two—Following received quote suggested by L L McDonald Director Department of Camping Boy Scouts of America that amateurs consult local scout headquarters about radio in camps period There may be opportunities for operators to secure fine vacation free of expense unquote.

June 26—Code Six—Following received quote country boys will be welcome at all Boy Scout Camps this summer period application should be made at nearest Scout Headquarters period plenty of fun and useful training according to announcement from National Scout Headquarters New York unquote.

June 27—Code Four—Following received quote Scranton Pennsylvania Boy Scouts Council has six radio operators and an experienced advisor who received training in military service in France it is announced by Boy Scout Headquarters unquote.

June 28—Code Two—Following received quote American Red Cross is considering the development of a plan to cooperate with the Navy and Boy Scout Headquarters unquote.

June 29—Code Eight—Following received quote more than one thousand camps will be operated by Boy Scouts of America this summer it is announced by National Director of Camping period many of them will have amateur radio stations.

June 30—Code Ten—Following received quote Five Boy Scouts of America comma one from each Borough of Greater New York comma have been chosen by competition to go on a tour of all the Great National Parks as guests of the far Western Travellers Association unquote.

TRACING RADIO STRAYS.

It is reported that all the amateur wireless telegraph operators of England are to be called on to help solve the mysteries of wireless wave antics and of strays—the electric forces often caught by wireless instruments, but which are recognized as stray electricity in the air.

It is now fairly well established, in connection with Eiffel Tower signals, that when it is raining at the sending end the receiving end is apt to be poor; but that if it is clear at the sending end and raining at the receiving end, the signals come along normally. If it is cloudy at both ends, the signals are better than ever. It has long been generally known that after sunset the strength of the wireless signals increases greatly; but the exact amount of this increase in thousands of cases is wanted for the study.

The subject of strays is a big one in itself; but if all the amateurs of the land were on the lookout for them, and sent in reports on all they noticed, it might be found that they travel on certain understood lines, like storms, or appear under certain conditions of weather.

HIS "RESISTANCE" WAS LOW!

Jim: Bill, had planned to get away with one of those transmitting condensers down at the radio station.

Joe: Were his plans carried out?

Jim: No, Bill was!

KENNETH COURTRIGHT.

CONNECT "A A" to your detector or amplifier, and "B B" to a 6-volt battery

MAGNAVOX

RADIO TELEMEGAFONE

Type R-1 with small horn $75
Type R-2 with large horn $93

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Ask for Bulletin 21020

THE MAGNAVOX COMPANY

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Quality—Efficiency—Economy

These are the three factors which combine to make all the equipment sold by us the best in the market today. A trial order will convince you. Our apparatus is service-tested. Look at the bargains below and then use your judgment.

COPPER AERIAL WIRE

50c per 100 Feet

Another large shipment of this excellent solid copper wire has just been received by us. The gauge is No. 14 and the wire runs 80 feet to the pound. We also sell No. 12 gauge at 80c per 100 feet. This size approximates 50 feet to the pound.

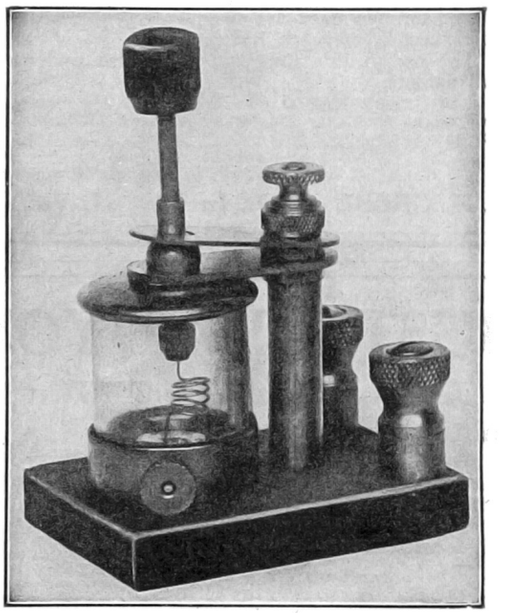
A FEW MORE BARGAINS

500 cycle test buzzer—shipping weight, 1 lb..... $0.80
75 ohm watchcase receivers—shipping weight, 1 lb..... 1.00
Marconi VT Audion bulb—class 2—shipping weight 1 lb... 7.00
Panel type rheostat—shipping weight 1 lb..... 1.00
4 prong VT sockets, aluminum—shipping weight 1 lb..... 1.50
Telephone plug and jack—slightly used—shipping weight 4 ounces—complete 0.85

Cash in registered letter, check or money-order must accompany all orders. If shipment by parcel post is desired include postage, otherwise material will be shipped by express collect.

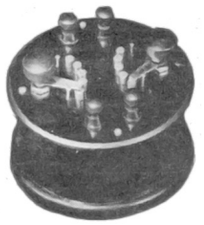
Our illustrated catalogue of 64 pages is now ready. 15c in stamps will secure a copy. This amount will be credited on your first order for $1.50 or over.

Electrical Specialty Company
Dept. R—48-50 So. Front St., Columbus, Ohio



Weather Proof Crystal Detector

The type of the detector illustrated is being sold at prices ranging as high as $4.50. Our price is $2.80. This instrument is absolutely dust and moisture proof. The crystal, which is one of galena mounted in a block of Woods metal, is encased within a glass cylinder rendering it impervious to atmospheric conditions. Has ball and socket joint. Shipping weight 1 lb. Price $2.80.



Hook'er to Yer Bulb.

The most wonderful Tuner in the world for only $15. Last month this Tuner beat in a test one of the NAVY STANDARDS at Ketchikan, Alaska.

10 Captains of ocean going ships have had their wireless operators install one of our tuners in the captain's cabin so the exact time by wireless can be had without using either tube, bell, or hand. "GREAT" says one old sea dog. "WHAT IN SAM HILL WILL YOU SMART ALECS GET UP NEXT?" European stations copied in day time and no fancy aerial is needed. A single wire about 40 long by 25 high will do the trick. London amateur W. R. Wade, Clifton, Bristol, promises report for the magazines to publish showing how the amateurs there read our sigs in England. Junk your funny wound coils and get a regular two pound tuner that you can use during the static season. 20000 meters maximum wave length. Hook up on bottom of tuner.

KNOCKED DOWN AND ASSEMBLED CONDENSERS.

Which kind do you want? Made for panel mounting and are complete with scale pointer and knob. Used all over the world now and still going strong. No. C.O.D. orders. Add parcel post. Buy from your dealers and send us his name if he cannot supply you. Canadian amateurs buy from local dealers or write us for nearest dealer. Formica tops and bases. Movable plates are screwed on and not clamped.

11 plate knocked down	$1.80
21 plate knocked down	2.25
41 plate knocked down	3.20
11 plate assembled	2.75
21 plate assembled	3.25
41 plate assembled	4.25

Sold by your dealer or

TRESCO—Davenport, Iowa

No Seals—No Secrets—*BUT SERVICE!*

There is only one Relay Receiver, the

GREBE RADIO

Type CR-3
Relay Receiver

Inspection of the interior of this Receiver reveals design and workmanship fully in keeping with its outward appearance.

The circuits used are thoroughly explained in the instructions and blue prints which accompany each Receiver.

The use of this Receiver is licensed under the original Armstrong and Marconi patents.

The GREBE RADIO guarantee is absolute and unconditional. Each instrument manufactured by us must give satisfactory service. Our interest in the purchaser does not terminate with the sale.

Ask your dealer to show you our line of super-grade apparatus.
If he doesn't carry it, write us for catalogue, mentioning his name.

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A Few More Parts to Finish That New Receiving or Transmitting Outfit.

Loose couplers—$5.00 and up

Condensers—$3.25 and up

DOUBLEDAY-HILL ELECTRIC CO. D-H PITTSBURG TRADE MARK

Complete stock of Regenerated Sets, Amplifiers, Detectors and all other apparatus to make the set complete.

Our Guarantee and Service backs every article sold.

While in town do not forget to pay us a visit.

DOUBLEDAY - HILL ELECTRIC CO.

Radio Department, Desk B

715 12th St., N. W., Washington, D. C. **719-21 Liberty Ave., Pittsburgh, Pa.**

New Developments Expected for the Professional Radio Operator

We learn from an official of the United Radio Telegraphers' Association that a new system of grading operators was suggested to Admiral Benson by a committee representing the operators at Washington recently. By the proposed method experience and ability will be the main factors determining the pay of an operator. The grades would start with an apprenticeship license and gradually lead up to that of an expert and similar to the present system of grading mates and engineers of seagoing vessels. The method will, of course, be consistent with the examination requirements of the Department of Commerce but will probably be more severe than at present.

Rear Admiral Benson and Secretary of Commerce Chamberlain seemed favorably imprest with the suggestion, and more information on its fate will be announced later.

In general, the purpose of the proposed new arrangement is designed to improve the quality of operators as well as increase the pay of able men in due proportion to their experience and knowledge of radio.

DEALERS AND MANUFACTURERS EXPERIENCE DIFFICULTY IN SECURING RAW MATERIALS.

Amateurs often wonder and sometimes acquire considerable peevishness by delays they experience in receiving shipments of radio parts or instruments. These unpleasant conditions often result in bad feeling and unsatisfactory dealing. However, before passing judgment on the cause for delays, etc., purchasers should consider the great difficulty sometimes experienced by manufacturers in securing raw material and the consequent delays to the dealers.

One reason for this is that the great rush and demand for apparatus occurs during the fall and winter and thus the summer months remain comparatively idle. One way to assist these unfavorable conditions and at the same moment overcome delays at the time you most wish your instruments and parts, which is naturally in the winter, is for you to place your orders during the present period when the factories are comparatively working at low pressure. Thus manufacturers and dealers would better be able to gauge their requirements and consequent output.

DEATH OF MARCONI'S TEACHER.

Prof. Augusto Righi of Bologna has died at the age of 70. To most readers the announcement of this man's passing means nothing, whereas if Marconi died few would there be who would not know that the wizard of radio had passed the way of mortal flesh. And yet it was Prof. Righi who in his laboratory in the Italian city took up the boy with the Italian father and the Irish mother and taught him the wonders of the Hertzian wave which eventually resulted in Marconi's invention. Since Marconi was a very young man when he invented his system of radio telegraphy, using the principle that between the ether waves there was a "filler" which could be made to transmit energy thru space, he was not therefore very long from under the teaching of the Bologna scientist when the tutorship bore a fruit which has been a blessing to all mankind.

A "RADIO" PILOT.

The United States Navy Department has perfected its new "radio pilot." The system has been installed in New York Harbor, and eventually, it is expected, will end the usefulness of the picturesque pilot and his rig.

By means of electrically charged cables large vessels will be able to enter the harbor, even on the darkest nights. Two hoops are placed some distance from each other, composed of numbers of turns of fine wire, connected with a delicate electrical registering apparatus, which, in turn, is connected to telephone receivers. By means of the latter sounds are detected.

The hoops pick up the electric currents by induction thru the intervening air and water. By the relative strength of the induced currents it is possible to determine the distance of the right-hand and left-hand cables, and hence whether the ship is steering a middle course between them.

When one induced current becomes stronger than the other, the course of the vessel is altered until the two again balance each other. This occurs when the vessel holds a middle course. The radio pilot will probably be placed in operation in a few months.

A SHOCKING DEATH.

After the disappearance of some plates of glass from his condenser an amateur placed this sign above the same: Do Not Take the Glass Plates From This Condenser Unless You Want a *Die Electric.*

—*Fred H. Stephens.*

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AND
MOLYBDENUM
FANSTEEL PRODUCTS CO. INC.
MFRS. OF

TUNGSTEN	MOLYBDENUM
CONTACTS	SHEET
SPARK GAPS	ROD ½ INCH DIAM. TO .050 INCH DIAM.
BUTTONS	WIRE TO .020 INCH DIAM.
ROD ½ INCH DIAM. TO .050 INCH DIAM.	SPECIAL SHAPES
SHEET	

OUR LABORATORY WILL ANSWER YOUR QUESTIONS
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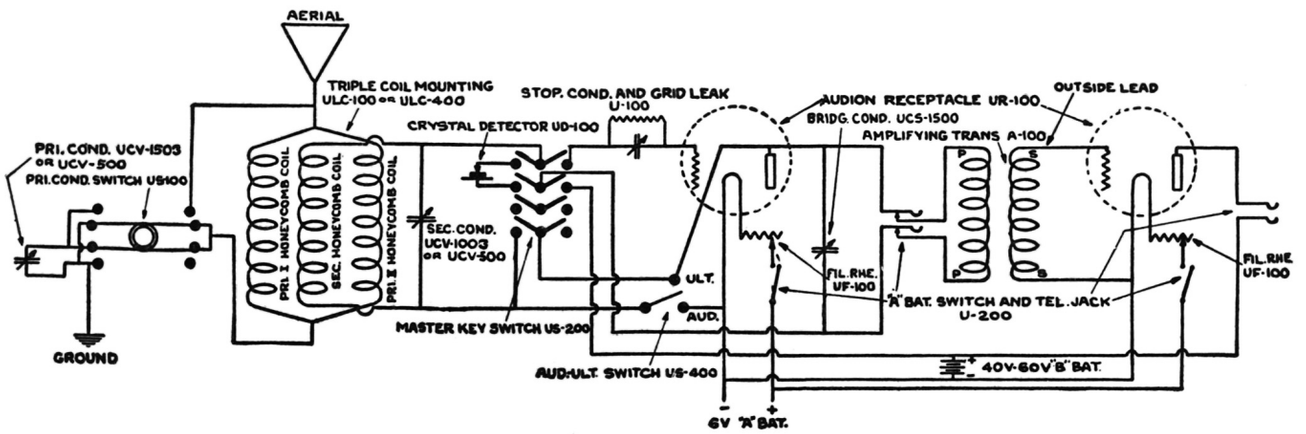

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NOTHING

WHAT'S BEHIND OUR NAME?
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"A SUPPLY COMPANY FOR THE RADIO AMATEUR"
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NEW MOTORS
FACTORY GUARANTEED
ALL SIZES
PROMPT DELIVERY

Charging Generators
Suitable for all lighting, Battery Charging and Power Requirements.

8 v. 10 amp.	$19.50
15 v., 10 amp.	$26.50
40 v. 6 amp.	$31.50
110 v. 2½ amp.	$31.50
110 v. 5 amp.	$52.50
40 v. 12 amp.	$52.50
110 v. 9½ amp.	$67.50
40 v. 25 amp.	$67.50
110 v. 18 amp.	$116.50
40 v., 50 amp.	$116.50
110 v. 26 amp.	$156.50
110 v. 50 amp.	$238.50
Moving Picture Arc Generator 60 v., 35 a.	$116.50

Polyphase Motors
2 and 3 phase, A. C., 220 v. 60 c., 1750 R.P.M., Complete with base and pulley

½ H. P.	$46.50
1 H. P.	$66.50
2 H. P.	$86.50
3 H. P.	$98.50
5 H. P.	$116.50
1 H. P. Special Grinding and Buffing Motor	$106.50

Direct Current Motors
110 or 220 volts, D. C., shunt wound, 1750 R. P. M. With base pulley and starting box.

¼ H. P. Washing Machine Motor	$28.50
¼ H. P., 32 v. Washing Machine Motor	$28.50
½ H. P.	$58.50
1 H. P.	$82.50
2 H. P.	$124.50
3 H. P.	$142.50
5 H. P.	$218.50

Single Phase Motors
110-220 volts, A. C., 60 cycle, 1800 R. P. M. with pulley

¼ H. P., 220 v. induction Washing Machine Motor	$28.50
¼ H. P., 110 v. grinding buffing motor	$28.50
½ H. P. induction, full load start	$46.50
½ H. P. repulsion induction For compressor service	$54.50
1 H. P. repulsion induction, Special Garage Motor	$74.50
2 H. P. repulsion induction with sliding base	$126.50
3 H. P. repulsion induction with sliding base	$146.50
5 H. P. repulsion induction with sliding base	$188.50

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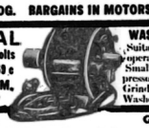
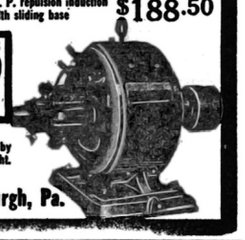
1/4 H.P. 110 volts A.C., 60 c S. P., 1750 R.P.M.
Complete, cord, plug and pulley



WASHING MACHINE MOTORS
Suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Etc.
$26.50 Each
Reg. Val. $34.50



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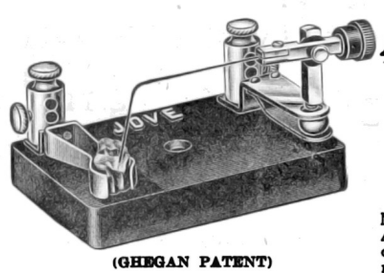

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Sample by Mail, $2.00
Tested Galena Crystal, 25c

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Logarithmic Decrement

By J. A. Culler
Professor of Physics, Miami University, Oxford, Ohio.

AMATEURS and young students often become very enthusiastic on the subject of wireless telegraphy and decide to learn all about it. All goes well until they strike a subject like *logarithmic decrement* and then they are stalled and begin to hunt about for easier spots. Wireless, in fact, is a very difficult subject if one wants to know *all* about it. The best way to prepare for an understanding of wireless is to study algebra, then follow later with other and higher branches of mathematics.

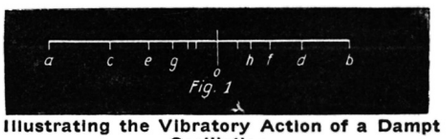
In this article the attempt is made to explain in the simplest possible manner what is meant by logarithmic decrement, so that anyone who knows the simple processes of algebra and logarithms can easily understand it.

Logarithmic decrement may be defined as the difference between the natural logarithms of two successive amplitudes of vibration in the same direction.

If this definition is not understood, keep coming back to it as you read further until it clears up.

Suppose a vibrating particle starts at *o* of Fig. 1 and swings to *a*, then to *b*, then back to *c*, then to *d*, and so on, the amplitude or distance of the swings to either side of *o* growing shorter each time until finally the particle comes to rest at *o*. This is called a *dampt oscillation* such as occurs each time there is a spark discharge from a condenser.

The ratio of the amplitudes of any two successive swings is the same; that is, is constant. The ratio of *oc* to *oa* is the same as that of *oe* to *oc*, or *og* to *oe*, etc.



Illustrating the Vibratory Action of a Dampt Oscillation.

Now if we find the natural logarithm of *oa* and then of *oc*, the difference between these logs. is the logarithmic decrement for vibrations in the same direction. The same value will be found by taking the difference of the logs. of *oc* and *oe*.

Let us suppose that *oa* is 100 and that the comomn ratio for amplitudes to the left of *o* is 4/5. Then 4/5 of 100 = 80; 4/5 of 80 = 64; 4/5 of 64 = 51.2, etc, giving a series of numbers in the column below headed "amplitudes." The natural logarithms of each of these numbers is given in the column headed "logs."

It is seen that while the numbers in the first column have a common ratio, their logs. have a common difference. The difference between any two of these logs. is the logarithmic decrement, usually represented by the Greek letter delta (δ).

Amplitudes	Logs.
100	4.6052
80	4.3821
64	4.1590
51.2	3.9359
40.96	3.7128
32.77	3.4897
26.21	3.2666
20.87	3.0435
etc.	etc.

In this particular illustration $\delta = .2231$.

It is assumed in wireless work that a vibration has ceased when its amplitude becomes 1% or 1/100 of the first one. So the total number of common differences is log. 100 — log. 1. The log. 100 = 4.6052

and log. 1 = 0. So the sum of all the common differences is 4.6052. If this number then is divided by the log. dec., the quotient will be the total number of vibrations less one. In the example above, 4.6052 ÷ .2231 = 20.6 and 20.6 + 1 = 21.6 vibrations.

The reason 1 must be added is because in any series of numbers that decrease by a common difference to zero, there will be one more number than there are common differences.

In wireless work it is not legal to have less than *twenty-four vibrations to each discharge of the condenser* and so this requires that the log. dec., to be legal, *must be .2 or less.* Then the operator at a receiving station can "tune in" any receiving station he wishes to receive and "tune out" the others.

PLANS FOR RADIO CENTER ARE MADE BY THE FRENCH.

The city of Bucharest will probably become a huge communication center for South Europe, both for radio and aviation, if present French plans are carried out. The Marconi company has offered to build a huge radio station in Rumania, which would handle business from the East as well as local business to the West, but it appears likely that the Rumanians will either continue their own radio service in connection with the Eiffel Tower and other stations in France, or else permit the French to establish such a station.

Both British and French firms, backed up by their governments, are also attempting to arrange a complete airplane service. The French propose to connect Paris, Vienna, Budapest, Bucharest and Constantinople in a general way, with branch services including Serbia, Bulgaria and Greece. It is hoped later to extend this service into Russia.

The establshment of these radio and airplanes communications are a continuance of the French policy of keeping Eastern and Western Europe connected.

ONE CENT A WORD FOR YOU

If you have a good true story to tell us about yourself and your station or any unusual radio occurrence or matter connected with radio, we want that story. We will pay one cent a word upon publication for all accepted stories. We desire you to feel that this magazine is your magazine, and we will do all in our power to make it so. We want to make it as human as it is possible. Will you help?

Write on one side of the paper only, and if you use a typewriter be sure to double space between lines. Handwriting should be clear and legible and written in ink. If you wish your manuscript returned, do not fail to enclose the necessary postage. Consider well the great value of good, clear photographs. Good photographs of a timely radio subject are *always* acceptable to us. Now go to it and earn some vacation money.—THE EDITORS.

LADIES, BEWARE!

Mr. Nuhub—"Why use so much rouge, my dear?"

Mrs. Nuhub—"For 'skin effect' of course."

—*E. Ray Arlidge.*

THAT SQUELCHING EFFECT, YOU KNOW.

Dubb—"Why is a married man like an efficient spark gap?"

Rubb—"I give up. Why is he?"

Dubb—"Because he is 'quenched.'"

—*E. Ray Arlidge.*

Static Eliminators are Still in the Experimental Stage

We all know that "strays" are still uncontrollable. The summertime is not over-friendly to radio work, and in order to cover the distances required it is important that you get out (or radiate) every possible erg of energy.

Dubilier Mica Condensers are recognized as the most efficient condensers available. They are employed by all stations which are covering exceptional distances. If you want to carry on your share of relay work effectively you should install a genuine Dubilier Mica Condenser.

There is a size for every station.

Look over this list and decide what type you want.

Type	Power Watts	Tested Voltage	Capacity	Price
D100	250	10000 volts.	0.007 mfd.	$19.00
D101	500	14000 volts	0.007 mfd.	30.00
D102	1000	21000 volts	0.007 mfd.	45.00
D103	1000	25000 volts	0.007 mfd.	50.00
D110	250	10000 volts.	0.01 mfd.	21.00
D111	500	14000 volts.	0.01 mfd.	35.00
D112	1000	21000 volts.	0.01 mfd.	50.00
D113	1000	25000 volts.	0.01 mfd.	55.00

Prices on other sizes and capacities on application.

When you want a condenser—wait till you can get a Dubilier.

Bulletin D1 giving prices and description of our complete line of condensers suitable for C. W. transmission and receiving work is yours for the asking. Send for it today.

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Builders and Specialists in Radio, Electrical and Laboratory Equipment.

SALES AGENTS for Electrical Products Mfg. Co., A. H. Grebe & Co., Dubilier Condenser Co., Richter and Byrne, Rawson Electrical Instrument Co., The Magnavox Company and others.

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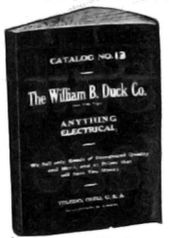
RADIOPHONE & "CW" ACCESSORIES

Our Rectifier-Transformer outfit supplies 350 V. D.C. to power VT's, and Low Voltage A.C. for heating filaments of Rectifier and power VT's. Unmounted 350 V. H. Winding Transformer..$12.00

2 Electrodyne 60-70 M.A. Rectifier VT's..... 14.00
2 Back Mounting, Non-Melting Bakelite Sockets. 2.50
Immediate delivery, include 10 lbs. postage charge.
Type J, 0-100 Milliammeter, 3" dia. Flush Type $6.00
1½ Henry Closed Core Choke Coil (150 M.A.)... 4.00
Moorhead 150-600 V. Experimental Power VT... 7.50
Western Electric 350 V. Type "E" VT-2..... 18.00
Send 4c for bulletins describing a new Variable Condenser, and all parts and building supplies for "VT" Transmitters, etc.

SOMERVILLE RADIO LABORATORY
102 Heath Street Somerville, 45, Mass.



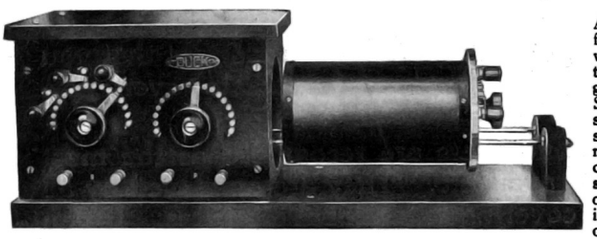
DUCK'S New Big 200-Page No. 14 Wireless Catalog and 100 Page Electrical Catalog

The wireless catalog mailed for 12c and the electrical catalog for 6c, either in stamps or coin, which amount you are privileged to deduct on your first order of $1.00. Catalog positively not sent otherwise.

This edition of our wireless catalog is the most complete and elaborate we have ever put out. It embraces everything in wireless worth while. As an encyclopedia of information it is invaluable. It is printed on excellent paper and with a beautiful cover. Your amateur friend will tell you that there never has been any wireless catalog to take the place of Duck's, and above all that you can absolutely rely on the quality of every instrument listed in this catalog. In a word it is all worth while catalogs in one.

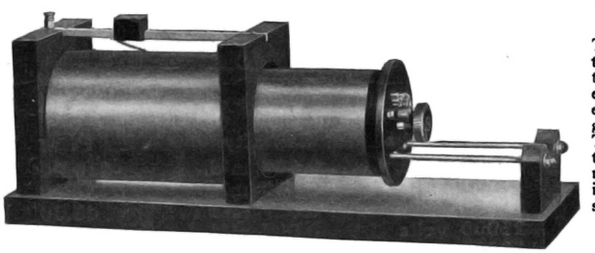
Audio Tron bulbs prepaid $6.00

We discontinued selling Audio Tron bulbs and accessories for a short time but we have again resumed their sale and can guarantee immediate delivery.



NEW MODEL 5BB. NAVY TYPE RECEIVING TRANSFORMER

A big improvement over our former model. Primary divided into four sections, with three dead end switches, greatly improving selectivity. Secondary divided into three sections, with two dead end switches, eliminating harmonics. The change in the construction of the guide rod support makes it possible to obtain a looser coupling. It is a wonderful improvement over our old model both in performance and appearance. Only $27.50.



OUR IMPROVED ARLINGTON RECEIVING TRANSFORMER

The secondary on our new type Arlington is divided into three sections with two dead end switches, eliminating dead end effect and harmonics and giving greater selectivity. The end support is similar to that on our Navy type permitting a looser coupling. It is a beautifully finished instrument.

Price Only $15.00

THE WILLIAM B. DUCK CO., 231-233 Superior St., Toledo, Ohio

AMPLIFY YOUR RADIO SIGNALS

With the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument.

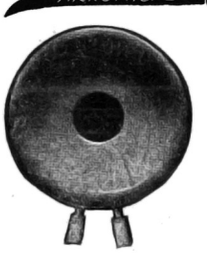
The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver.

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter. It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.

SUPER-SENSITIVE **Detectagraph** MICROPHONE DEVICES

Our Super-Sensitive Detectagraph Transmitter. Price, $8.00 Complete



Our Special No. 25 Loud Talking Receiver. Price, $4.50 Complete

Detectagraph Rheostat, especially made for amplifying circuits. Price, $2.00 Complete

Super-Sensitive No. 40 Receivers to be used in connection with Detectagraph-Transmitters, $10.50

The Detectagraph Junior Deaf-Phone $18.00

Equal to any $35 instrument made. Outfit consists of Super-Sensitive Transmitter with cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and Two Batteries.

Adjusted Model "B" Horn, with No. 20 High Grade Loud Talking Receiver, Cord Plugs and Desk Stand Base. Price, $12.00 Complete

Adjusted Model "C" Horn, with No. 20 High Grade Loud Talking Wall Receiver, Cord Plugs and Wall Base. Price, $12.00 Complete

Detectagraph $18.00

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

Order direct from ad.

Or write for free descriptive circular.

G. BOISSONNAULT COMPANY

25 CHURCH STREET NEW YORK CITY

Makers of Super-Sensitive Microphone Devices

Design of a Radio Receiving Set

(*Continued from page 77*)

give the desired wave length ranges. The Duo-Lateral or Honeycomb coils lend themselves readily to the construction of a receiver of this sort. The inductance values required to give the wave length (400-3000 meters) range on the assumed antenna and type of condenser are listed as follows:

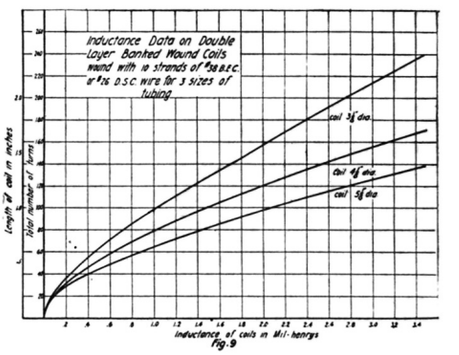
Primary:

.5 m.h. 1 m.h. 2 m.h. 4.5 m.h. 9.5 m.h.

Secondary .3 m.h 1 m.h.

MECHANICAL REQUIREMENTS.

The electrical constants have been determined, but if we are to construct a receiver it is necessary to know how many

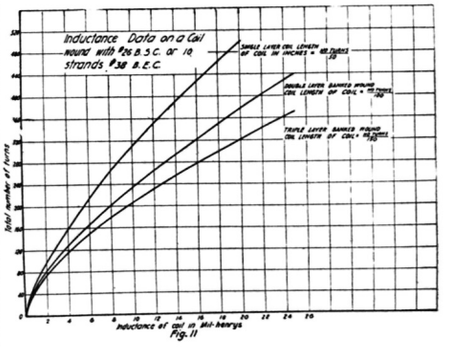

Inductance Data on Double Layer Banked Wound Coils wound with 10 strands of #38 B.E.C. or #26 D.S.C. wire for 3 sizes of tubing
Coil 3" dia.
Coil 4" dia.
Coil 5" dia.
Length of coil in inches
Total number of turns
Inductance of coils in Mil-henrys
Fig. 9

Inductance Data for Double Layer Banked Wound Coils.

turns of wire on what size of a core is necessary to produce the desired inductance value. It is also necessary to decide upon the mechanical arangement of the apparatus, the method to be employed for coupling the primary to the secondary, etc.

HOW YOU CAN BE SURE THAT YOUR COUPLING BETWEEN PRIMARY AND SECONDARY COILS IS AMPLE.

The coupling between the primary and the secondary circuits should be variable from 0 to a value of at least 5%. Assuming a maximum coupling of two coils end on to be about 50%. The product of one half the percentage of the total inductance contained in the coupling portion of the primary circuit and the percentage of the total inductance contained in the secondary circuit must be greater than 5%.


Inductance Data on a Coil wound with #26 B.S.C. or 10 strands #38 B.E.C.
Total number of turns
Inductance of coil in Mil-henrys
Fig. 11

Data for a Coil Wound with No. 26 B.S.C. or 10 Strands of No. 38 B.E.C.

Suppose the coupling coils of our receivers are each 1 m. h. and there are three antenna loading coils of 1, 2.5, and 4 m. h., the maximum coupling will be greater than 5%.

$$\text{Since} \frac{1}{1+1+2.5+5} \times 50\% \times 1 = 5\%$$

HOW SHOULD WE DESIGN OUR INDUCTANCE COILS?

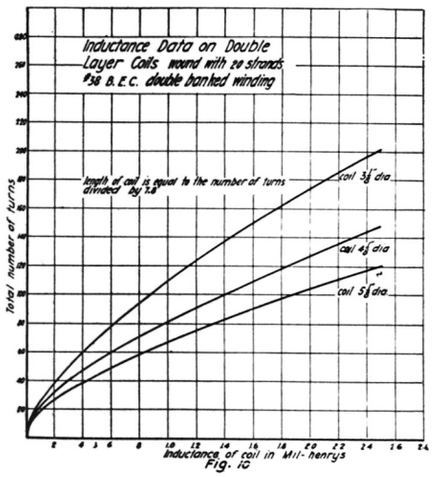
The best inductance is one in which the ratio of diameter to length is 2.5, and we can determine the size of the coupling coils by choosing a size of tube which most nearly gives this figure. Suppose 10 strands of No. 38 *inductometer* wire is available for the coils. Then by referring to Figs. 8, 9 and 10 we can select the proper coil sizes and determine the number of turns of wire.

For the shorter wave lengths, the single layer solenoids are superior to most of the other forms of coils due to their low distributed capacity.

From Fig. 8, a 1 m. h. coil on a 4⅛" tubing will contain 92 turns and be 1.85" long.

From Fig. 9 a 2½ m. f. coil with a 2 layer banked winding will contain 137 turns and be 1.37" long.

From Fig. 11 a 5 m. f. coil with a double


Inductance Data on Double Layer Coils wound with 20 strands #38 B.E.C. double banked winding
length of coil is equal to the number of turns divided by 1.8
coil 3⅝ dia.
coil 4⅝ dia.
coil 5⅝ dia.
total number of turns
Inductance of coil in Mil-henrys
Fig. 10

Inductance Data for Double Layer Coils Wound with 20 Strands of No. 38 B.E.C. Double Banked Winding

banked winding will contain 154 turns and be 1.54" long.

The two and three layer banked windings spoken of in the preceding paragraphs are special forms of multilayer coils designed to keep down the distributed capacity.

Fig. 6 illustrates a tube carrying a single layer, a 2 layer and 3 layer banked windings and also shows two views of honeycomb wind.

The illustration is an attempt to show how the consecutive turns are placed on the tube. From this it is seen that the winding is a progressive multilayer winding where the difference in potential between the layers at any point is only that set up between a few turns.

These coils can be arranged in a number of satisfactory ways. One arrangement together with the necessary dead ending switches is shown in Fig. 13.

By referring to Fig. 14 a diagram may be seen of the connection of the receiving set which has been described and explained in this article.

RADIO PHONE 3,000 MILES.

William Wrigley, Jr., of Chicago, has recently installed a radio telephone set which carried his voice 3,000 miles distant from Chicago to the Catalina Islands.

The telephone was tested for the first time several weeks ago when conversations were held between persons in Illinois and in the Catalina Islands. Voices heard at the Chicago end of the "line" were as audible as those in ordinary long distance telephone calls, it was said.

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Mail Order Service

Our claim of "Personal Service to the Consumer" has been more than upheld and we have pleased our many clients by our prompt and courteous attention to their wants.

Our early success along these lines has prompted us to establish a Mail Order Department, so that out-of-town Radio Men can realize and feel the strength of our service and know that when they order a piece of apparatus they can get it at once and not have to wait until it is manufactured or otherwise secured. We carry a complete stock and list some of the more important instruments below:

AUDION CONTROL PANELS

Radio Craft Detector Unit	$15.00
Radio Craft 2 Step Amplifier	50.00
Radio Craft Detector and 2 Step Amplifier	70.00
RORA Grebe Detector Unit	11.00
RORH Grebe Detector Unit with Batteries	17.00
P 400 De Forest Unit	12.00
P 401 De Forest Unit, with Oak finished cabinet	14.75
P 402 De Forest Unit, with 40 Volt "B" Battery	22.00
P 500 De Forest Audion, Ultra Audion, complete with 40 V. "B" Battery	25.00

DETECTORS (Crystal)

RPDB Grebe Single	$2.75
D101 DeForest with crystal	2.80
AMCO Crystal Detector	1.75
Tested Galena Crystals mounted ready for use	.25

GRIDLEAKS

Marconi complete Holder and Leak	$1.00
ROCA Grebe Condenser and Leak	1.60

LOOSE COUPLERS

Arnold 3000 Meter Loose Coupler	$22.50
CE F673 3000 Meter Coupler	14.00
Signal No. R21 3000 Meter Coupler	18.50

OSCILLATION TRANSFORMERS

International TXL—100A	$16.75
Signal R13	16.00

ANTENNA SWITCHES

463 Murdock, Switch Stands up to 1Kw	$4.50
F658 Clapp Eastham, Three Pole with Bakelite Antenna Post	12.50

AMPLIFIERS

RORE Grebe Single Step Audio Frequency Amplifier	$23.00
switch control	45.00
RORJ Grebe 2 Step Amplifier with cam	
RORG Grebe Detector and 1 Step Amplifier	43.00
RORD Grebe Detector and 2 Step Amplifier	65.00
Radio Craft Co. 2 Step Amplifier	50.00
Radio Craft Co. Detector and 2 Step Amplifier	70.00
P 200 DeForest 2 Step Amplifier with "B" Battery	70.50

BUZZERS

55 Mesco Buzzer	$2.25
Century Buzzer	2.25
251 Nickelplated	.80

CONDENSERS

General Radio 182a	$12.00
C.V. 500 DeForest	6.25
366 Murdock	4.75
367 Murdock	4.75
368 Murdock	3.75
F800 Clapp Eastham	7.50
F800A Clapp Eastham	9.50

SOCKETS

156 General Radio	$1.75
550 Murdock	1.00
SI. Radio Service	1.20
R300 DeForest	1.50

HOT WIRE AMMETERS

General Radio No. 128 0-1 or 0-2½ Amperes	$5.00
Roller Smith 0-2½ Amperes	7.00
Extra Shunts	.75

"B" BATTERIES

766	Amer. Eveready 22½ V. 10 Amp	$3.50
7623	Standard 22½ V.	1.35
7625	"B" Batteries,	2.40
7650	Variable	3.25
9280	Cyclone 22½ V. 5 Amp	1.00
9281	Cyclone 10 Amp	2.00

AMPLIFYING TRANSFORMERS

Acme, specially mounted	$5.00
Acme, unmounted	4.50
Federal 226w	7.50

DUO LATERAL COILS

U.S.	25	$ .90
U.S.	35	1.00
U.S.	50	1.10
U.S.	75	1.20
U.S.	100	1.30
U.S.	150	1.40
U.S.	200	1.50
U.S.	250	1.60
U.S.	300	1.80
U.S.	400	2.00
U.S.	500	2.20
U.S.	600	2.50
U.S.	750	2.70
U.S.	1000	2.90
U.S.	1250	3.50
U.S.	1500	4.00

HONEY COMB COILS

L.	25	$1.40
L.	35	1.45
L.	50	1.52
L.	75	1.60
L.	100	1.70
L.	150	1.80
L.	200	1.90
L.	250	2.00
L.	300	$2.10
L.	400	2.25
L.	500	2.40
L.	600	2.65
L.	750	2.80
L.	1000	3.00
L.	1250	3.35
L.	1500	3.60

Instruments and parts listed above will be sent postpaid to any part of the United States.

Our word of honor to you is our guarantee. Let us prove it.

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Take a Dollar Bill,

Fill out the attached coupon, send both to the Electro Importing Company, 231a Fulton Street, New York City, and by return mail you will receive your

Skinderviken Transmitter Button

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Gentlemen:—Enclosed please find One Dollar. Ship at once one Skinderviken Transmitter Button to

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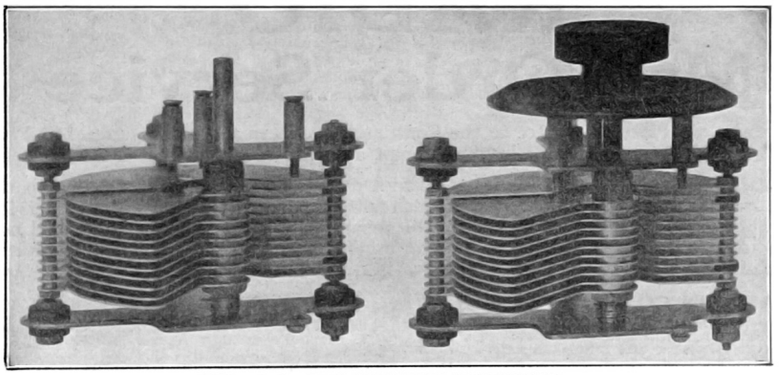
The "A. R. CO." Variable Condenser



THE "A. R. CO." VARIABLE CONDENSER

illustrated above, is made in two capacities—.0005 Mfd. and .001 Mfd. The rotary plates are rounded on one end, affording a straight-line capacity—a valuable feature in wave meter work. The condenser is furnished unmounted only but with the addition of Dial and Knob, if desired. Dial is of moulded composition, scale in white—0-100 reading. Bakelite Knob. We can guarantee this condenser in every way as to quality, reliability and satisfaction. The low price is decidedly an innovation.

PRICES:

Capacity	Unmounted	With Dial and Knob
.0005 Mfd.	$5.00	$6.00
.001 Mfd.	6.25	7.25

"BULLETIN 14"—describing and illustrating the best in RADIO EQUIPMENT will be mailed upon receipt of 10 cents in stamps—this amount may be deducted on your first order of $1.00 or over.

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Users Are Provers

"My Brandes sets brought in Coast stations louder and clearer than the other phones with which the station was supplied." (Name on Request.)

Brandes Wireless Headsets

Clear Tone Light Weight
Dependable Service

Score 100% efficiency in actual use. Sharp, Unblurred, Readable Signals assured by

"Superior" Set—2000 ohms, $7.

"BRANDES MATCHED TONE"—

Exactly matching the tone of both receivers in each set and thus eliminating all confusion due to unmatched harmonics.

TRIAL OFFER *Buy a Brandes Superior Headset and use it critically for ten days. Then, if it doesn't come up to our claims or your expectations, return it and your money will be cheerfully refunded. Test it—compare it with others—for sensitiveness, clearness, distance. Prove for yourself the fine quality, the "matched tone." The two diaphragms, toned exactly alike, strengthen the signals and prevent blurring. Used by many U. S. Government experts, and experts abroad; by colleges and technical schools; and by professionals and amateurs everywhere.*

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HAVE YOU SOMETHING TO SELL OR EXCHANGE?
A classified ad in Radio News will reach 40,000 at a cost of only 3 cents a word.

Radio Dictionary

(*Continued from page* 93)

Myria—Ten thousand.

Na.—See Sodium.

Napierian Logarithms.—Nap. Logs. Logs to base 2.71828 obtained by multiplying com. log. by 2.30259.

Natural Magnet.—Substance which is naturally a magnet. See Loadstone, also Magnetite.

Natural Wavelength.—Length of wave produced by aerial's own inductance and capacity. In single and parallel wire aerials either horizontal or perpendicular, wavelength is about four and a quarter times the length of aerial. In a T Aerial is about five times. In the Umbrella type about five times.

Nautical Mile.—2,029 yards, or 1.1528 statute miles. Sometimes referred to as Naut or Telegraph Naut.

Negative Corpuscle.—See Electron.

Negative Pole.—One by which current is said to return to source after having passed through circuit.

Neutral Body.—One not being electrified. All matter is capable of electrification.

Neutral Line of Magnet.—Middle portion between the two poles where no magnetism is apparent.

Neutral Wire.—Middle wire of Three-Wire System, which see.

Ni.—See Nickel.

Nickel.—Ni. White metallic element similar to iron. Hard, malleable, ductile and tenacious. A. W. 58.3. S.G., 8.9. Mlt. Pt. 2642° F. Elec. Chem. Eq. 0.000,304,3. S.R. 12.323. Is slightly magnetic.

Nitrogen.—Colorless, odorless, and inactive gas, forming about four-fifths of the atmosphere. N.A.W. 13.93. S.G. (Air 1) 0.967.

Nodes.—Points of zero current or potential in an oscillating circuit, whether closed or open. Zero points in a wave train. See Anti-nodes.

Non-Inductive Coil.—Is formed by doubling the wire and winding from the loop as one end.

No-Volt Release.—A small electromagnet inserted in field circuit of a motor in such a position that it holds the handle of starter in place on the last stud. Should the supply current fail, magnet becoming demagnetised and allows a spring in the handle to bring it back to the "off" position.

North Magnetic Pole.—Lat. 70 North. Long. 97 West.

North Pole.—See Polarity of Magnets, also North Magnetic Pole.

Non-Inductive Circuit.—A circuit which possesses very small or negligible inductance. Such an inductance can be made by doubling a single length of wire and winding it on a bobbin, so that a current flowing through it makes as many turns one way as the other, and there is little or no self-linked magnetic field.

O.—See Oxygen.

Octahedrite.—See Oxide of Titanium.

Ohm.—Unit of resistance. Resistance offered by a column of mercury at temperature of melting ice. 14,452 grammes in mass, of constant cross section, and having a length of 106.3 cms. Circuit has resistance of one Ohm when one Volt is required to force a current of one Ampere through it. Voltage divided by Amperage gives Ohms.

Ohm's Law.—Current in Amps. is equal to pressure in Volts divided by resistance in Ohms.

Omnibus Bars.—Same as Bus Bars, which see.

Opposing E. M. F.—See Back E.M.F.

Ordinates.—Perpendicular distances of a curve plotted on squared paper. See Co-ordinates, Absicca, and Locus.

Oscillating Current.—Alternating current having a frequency, of hundreds of thousands, or even millions, per second.

Oscillation Transformer.—See Jigger.

Oscillations.—Alternating currents of very high frequency are called electrical oscillations. If the amplitude is constant they are called sustained or persistent or undampt oscillations; but if the amplitude dies away, they are called dampt oscillations. If the oscillations take place with the natural frequency of the circuit and without any external impressed electromotive force, they are called free oscillations, but if they take place under the action of an external E.M.F., the frequency of which is not in accord with the natural frequency of the circuit, they are called forced oscillations.

Oscillation Valve.—See Valve.

Oscillator.—A device for producing oscillation. See Hertzian Oscillator.

Oscillatory Circuit.—A circuit possessing Inductance and Capacity through which an oscillating current will flow.

Oscillation.—See Valve Oscillator.

Oscillograph.—Instrument somewhat similar to Mirrow Galvanometer, for showing curves of oscillating or alternating currents.

Overload Release.—An electric magnet inserted in the main circuit in such a position that should current become too strong for safety of machine the no-volt release is short circuited and driving current switched off.

Oxide of Titanium.—Potential mineral rectifier. Sometimes called Octahedrite or Anastase.

Oxygen.—Colorless, odorless gas, A.W. 15.88.

P.—See Phosphorus.

P.A.—See Plain Aerial.

Paper Condenser.—One usually formed with tin-foil, having a dielectric of paraffin-waxed paper.

Parabolic Curve.—One having one of its factors in proportion to the square of other factors.

Paraffin Wax.—S.I.C. 2.3.

Parallel.—When two or more paths are open to a current they are said to be in parallel. Also known as Shunts.

Partition Insulator.—An ebonite tube having a steel rod running thru its centre with wing nuts at each end. Used for continuing a circuit through a wall or partition.

Patent.—A privilege granted by any recognized government on payment of certain fees, whereby a person is permitted the monopoly of manufacture and sale of a certain invention for a term of years.

Patent Agent.—A specialist in Patent Law, who undertakes for a certain fee to assist in obtaining patent rights for an intending Patentee.

Patent Assignment.—The transfer of patent right to another person who thereby becomes, from a legal point of view, the Patentee of that invention.

Patentee—The person to whom the letters patent are granted, not necessarily the inventor.

Patent Office.—American, U. S. Patent Office, Washington, D. C. British, The Comptroller, The Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C.

Patent Valid.—A patent that can be upheld in a court of law.

Pb.—See Lead.

PbO.—See Lead Monoxide.

PbO_2.—See Lead Peroxide.

$PbSO_4$.—See Lead Sulphate.

P.D.—Potential Difference. Pressure between two points of a circuit. See E.M.F.

Percentage Coupling.—Difference between the two resultant wavelengths of aerial

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(Wireless or Morse)

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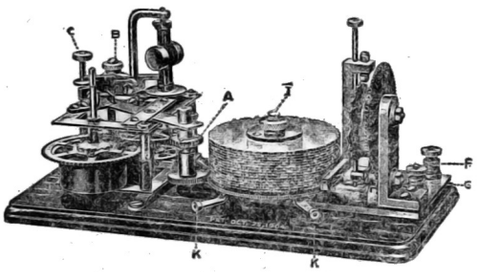
The Omnigraph is an *Automatic* Transmitter that teaches you both the Wireless and Morse Codes, at home, without any expense except the cost of the machine itself. Merely connect to battery and your Buzzer, or Buzzer and Head Phones, or to your Sounder and the Omnigraph will send unlimited messages by the hour, *at any speed* you desire.



USED BY THE U. S. GOVERNMENT

The Omnigraph is used by the Government in testing all applicants applying for a Radio License. It is also used extensively by the large Universities, Colleges and Telegraph Schools throughout the Country for teaching Wireless and Morse.

Hundreds of the Army's skilled operators who served during the war learned with the Omnigraph.

Let The OMNIGRAPH Teach You Wireless

For a few dollars you can have a complete outfit that will make you an experienced operator in the shortest possible time. No hard, laborious work—just learn by listening. The Omnigraph is adjustable so you can start receiving messages slowly, gradually increasing the speed as you become proficient.

You'll be surprised how quickly you will attain speed. Even if you are already an operator the Omnigraph will help you. It will make you more proficient, more accurate and more confident. Thousands of Omnigraphs are in use today and thousands of operators owe their success to them.

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Send for a catalog today, showing the 3 different models, $12.00 to $28.00. Every Omnigraph is sold with the absolute guarantee that you must be satisfied or your money back for the asking. Mail the coupon today—the catalog will come to you by return mail.

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26 F Cortlandt St.,
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The First Wireless School in America.
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Day and Evening Classes.
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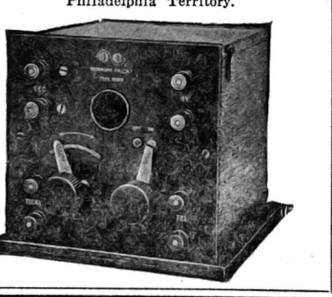

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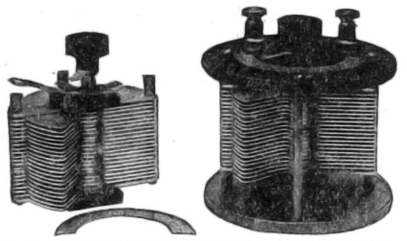

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circuit expressed as a percentage of the natural wavelength. The International Radio Convention agreed to forbid any larger percentage than fifteen as it would produce too much jamming.

Perforator.—Machine for perforating paper tape with holes for dots and dashes. The prepared paper is then run through an Automatic Transmitter, the holes permitting small metallic wheels to complete the circuit for necessary lengths of time to produce Morse Signals.

Perikon Detector.—Zincite in contact with Chalcopyrites.

Period.—Time required for one complete alternation of an A.C. or for one complete oscillation in a wave train. In the latter, time required to produce one complete wave.

Periodicity.—The frequency with which a certain event takes place. Of a convertor is the number of complete alternations per second in the generated current.

Periphery.—The outer edge of a wheel or disc.

Permanent Magnet.—One which retains its magnetic qualities after the source of magnetism is removed. Steel has this property most.

Permeability.—The property of concentrating Magnetic Lines of Force possessed by all magnetic substances. Magnetic Conductivity.

Phase Angle.—Amount of Lead or Lag of a current expressed in degrees of the complete cycle of 360 degrees, instead of in difference of time.

Phase Difference.—The difference in time between maximum current and maximum voltage being reached in an alternating current. See Lag and Lead.

Phase Relation.—Lead, Lag, or Phase Angle.

Phase Swinging.—See Hunting.

Phenomenon.—An unusual appearance or occurrence.

Phonographic Recorder.—Used to "read" rapid transmission Sounds produced in receiving telephone are recorded on a rapid rotating gramophone record, which is then rotated slowly, reproducing the signals at any desired speed the operator may require.

Phosphorus.—P. Non-met. element. A.W. 30.77. S.G. 1.83. Mlt. Pt. 44.3° F.

Phosphor Bronze.—An alloy of phosphorus with copper and tin. Has great strength and can be hammered or rolled whilst cold. Largely used for aerial wire.

Photographic Recorder.—High speed recorder. The action of one form is: Oscillations passing through a piece of high resistance wire heat it. This heat acting on the junction of a thermo-electric couple gives rise to an electric current, which, passing through a sensitive galvo, deflects a small shutter permitting a beam of light from a suitable lamp to fall on to a moving film of photographic material. The film, when developed, shows the message recorded in distinct dots and dashes.

Pilot Lamp.—One employed to show presence of current in a circuit.

Phase.—When an oscillation goes through a complete cycle within a certain periodic time, its condition at any one moment may be expressed by stating the fraction of the periodic time which has elapsed since the quantity last passed thru its zero value, and this is called its phase. It is generally expressed in terms of angular measurements, i.e. at so many degrees, taking the complete period to be 360 degrees. Two periodic quantities may therefore be said to agree or differ in phase.

Pitch.—The width of the coils of a drum armature. Also called Step and Throw.

Plain Aerial.—P. A. An oscillating circuit consisting solely of a condenser formed by the aerial and earth wires being sepa-

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rated by a spark gap. This system gives good radiation but damping is great, therefore, selectivity very poor. See Hertz Oscillator, and compare.

Planté Plates.—Accumulator plates made of sheets of lead "formed" by charging and discharging until the condition is that necessary for plates of secondary cell. Original type devised by Planté, 1860. Modern types are now formed by chemical preparation. See Faure Plates.

Platinum.—Pt. Hard white, lustrous metallic element. Malleable ductile, and tenacious. Expands at the same rate as glass. Very high melting point. A.W. 193. S.G. 21.5. Mlt. Pt. 3227°F. S. R. Annealed 10.917.

Platinoid.—Alloy of about 75% Brass, 23% Nickel, and 2% Tungsten. Only difference to German Silver is the addition of Tungsten.

Plugs.—Round brass rods, fitted with wooden or ebonite handles, having a hole down centre to receive flex wire, which is attached to rod by screws. Used in connection with plug sockets fitted on various instruments where quick changes of connections are required.

Polarized Relay.—One in which a magnetised swinging arm is placed between poles of two electromagnets. When current passes, one pole must change, so that arm is now attracted by one and repelled by the other. Much more sensitive to weak currents than the ordinary relay.

Polarization.—The partial changing of the polarity of a cell due to hydrogen bubbles forming on the negative plate. See also Local Action.

Polarity of Magnets.—The pole which seeks the Geographical North Pole is termed the North Pole of the Magnet, but is in reality a South Pole, since likes repel and unlikes attract. The same applies to the South Pole. For this reason they are generally referred to in text books as the N. Seeking and S. Seeking Poles. They are commonly named after the pole which they seek.

Poles.—See Magnetic Poles.

Polyphase.—Two or more circuits in which the rise and fall of E.M.F. of their alternating currents are not "in step" or do not occur at the same time in both circuits.

Polyphase Alternator.—One which produces alternating currents all of same frequency but each one leading the next in phase by a definite angle. If more than three such currents (triphase) are present in a circuit the currents are usually termed polyphase. An ordinary A.C. generator is a Uniphase machine.

Porcelain Cleats.—See Cleats.

Port.—Left-hand side of a ship, looking forward. Red light.

Positive Terminal Pole.—One from which it is conventionally assumed current commences to flow round a circuit. Actually, electrons flow from Negative to Positive, as unlike charges attract, and electrons are negative.

Potassium.—K. Kalium. Soft silvery metallic element. Requires keeping in oil, or it will ignite. Burns when placed on water. A.W. 38.86. S.G. 0.87. Val. 1. Chem. Eq. 38.86.

Potential.—Latent. Existing in possibility but not in act. Also Electrical Pressure above or below zero, i.e., of the earth. See D.P., E.M.F., and Volt.

Potential Difference.—P.D., D.P., E.M.F. Unit, Volt (V). That electric pressure which steadily applied to a conductor with a resistance of one Ohm, produces a current of one Ampere.

Potential Energy.—Restrained energy. Energy of position.

Potential Rectifier.—A crystal or other form of rectifier which requires an initial current to pass through it to become sensitive.

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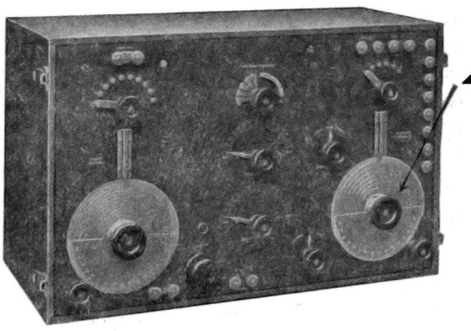

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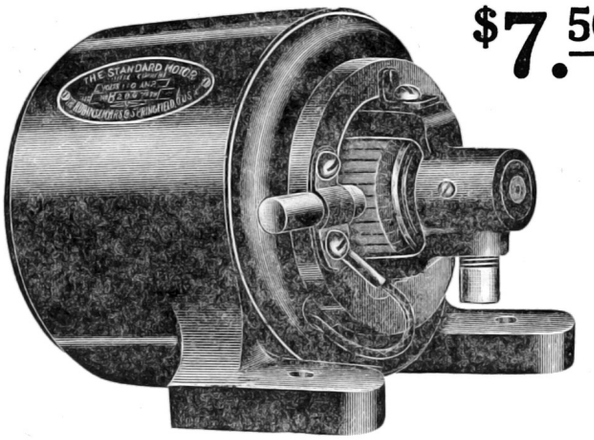

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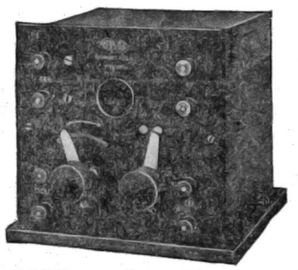

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By NELSON EMMONS, JR.

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Often the condenser will be cracked around the edge. If, upon examining the section, this crack can be seen, insert a chisel in the crack and force the condenser open. Split the condenser apart from the bottom or sides, wherever the crack happens to be. It will usually break apart in the right place with very little trouble. When you have broken it apart, cut off the copper strip that connects the copper plate and remove the large copper plate. Then close up the condenser and put it back in the rack. It will be just as good as new, but with a little less capacity, of course.

If the condenser is not cracked you will have to take off the copper connector pieces and test out the little copper tabs with a spark coil. When you have found the blown-out plate you will have to split the section apart with a sharp chisel and hammer. It will take a great deal of care to break the condenser apart in the right place without shattering the rest of it, but with a little patience it can be done. When you have broken it apart, take out the copper plate and close it up again. It may be sealed with a little sealing wax, but this is not absolutely necessary.

THE RADIOPHONE IN CALIFORNIA.

Southern California radio amateurs are having a real treat nowadays. For some time they have been feasting on the radiophone messages transmitted from various members of the Pacific Fleet stationed in Los Angeles Harbor, but recently an entirely new field of enjoyment has been opened up in the shape of the radiophone communication established between Long Beach and Santa Catalina Island. The project is in charge of the Pacific Telephone and Telegraph Company. Exact description of the method used has not been made public, but it is understood that any resident of either Long Beach or Catalina Island may talk with any other resident thru the regular 'phone installation in his home. The system is said to be the first of its kind in the world and will be in commercial use some time during July. The distance covered is about 25 to 30 miles and, during the tests of the last month, amateurs in Long Beach have clearly read both stations, using a simple crystal set. The calling system employs a bell device which is plainly audible all over the receiving room.

Contributed by CURTIS E. AVERY.

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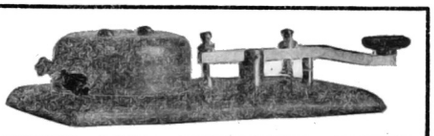

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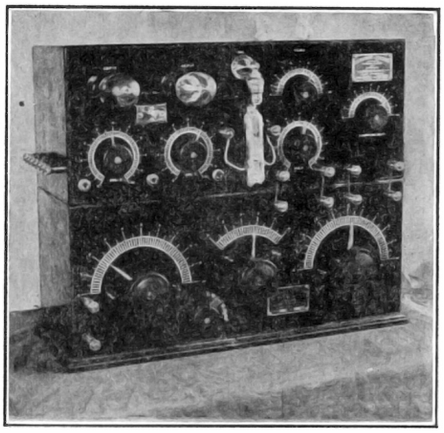

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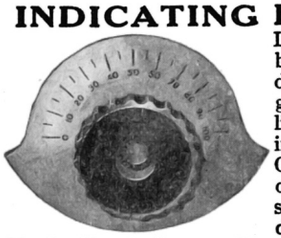

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The Construction of a Cage Type Antenna

(*Continued from page* 81)

hoops in this manner: Place the mid-point of the wire under the washer on the outside circumference of the hoop and against the screw. Now take a half turn each way around the screw leaving the ends of the wire protruding out perpendicular to the plane of the hoop, and lock down nut securely on washer; this holds the "fastener" in place. When you have finished putting the fasteners on, the laborious part of the job is over. Now cut the antenna wire into six equal lengths and stretch them taut between two supporters. At a point 2½ feet in from each support insert a hoop and secure the antenna strands to the hoops by twisting the ends of each fastener around a strand. This method of fastening in the hoops makes it impossible for them to slip, so care must be exercised in placing the hoops in their proper positions before making them fast to the antenna strands. Each of the other two hoops are inserted at points 16 2/3 feet distant from the end hoops. The form of the antenna now should be that of a cylindrical cage with a cone at either end. To insert the 10" insulators, unfasten one end of the cage, bunch the loose ends in the cone and pass them through one eye of the insulator; now separate the ends and wind each one back onto a strand in the cone. The other where the loose ends are wound back into insulator is fastened similarly, except that the cone a length of about six inches should be allowed for soldering on the antenna lead-in. The lead-in should consist of six wires of the same gauge as that used in the antenna proper, and these should be bunched at the vertex of the cone and wrapped with wire at intervals of two feet down to the lead-in insulator.

An antenna of the above dimensions, using a 30-ft. lead-in, and supported at an average elevation of 40 feet, has a natural period of 180 meters, which allows for the secondary inductance of the oscillation transformer to bring the open circuit up to 200 meters.

Simple Amplifying Transformer and Mountings

(*Continued from page* 78)

connections from the primary and secondary of the coil can then be soldered to the metal binding posts which came with the porcelain base already mentioned.

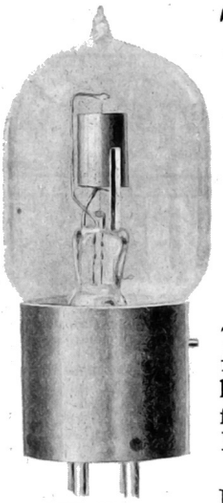
A celluloid cover (not shown) can be bought for ten cents in the form of a powder puff box, and this will just fit over the entire device which can be back mounted on a phonograph record, thus making a very presentable instrument.

Contributed by R. U. CLARK, 3D.

RADIO TORPEDOES.

An invention by a French wireless engineer, M. Dunoyer, will completely change the whole character of naval warfare, if its claims are fulfilled.

It consists of what he calls an "electric safety lock." The mechanism to direct the course of a torpedo and secure its explosion against an enemy warship can be worked not only by wireless waves of the right length but also by a proper sequence of Morse signals. Any error in the right sequence of dots and dashes would run the mechanism down to zero again and render the torpedo harmless. Each torpedo launched would have its own key sequence of dots and dashes, and so the enemy would be unable to tamper with it.



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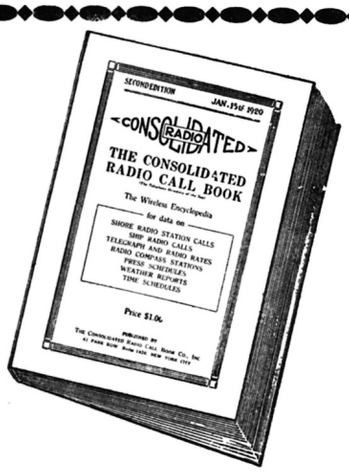

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Newman-Stern Co., 1874 E. Sixth St., Cleveland, Ohio
Nola Radio Co., 134 Chartres St., New Orleans, La.
E. P. Noll & Co., 21 No. 7th St., Philadelphia, Pa.
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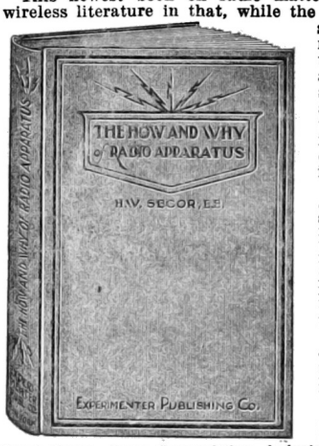

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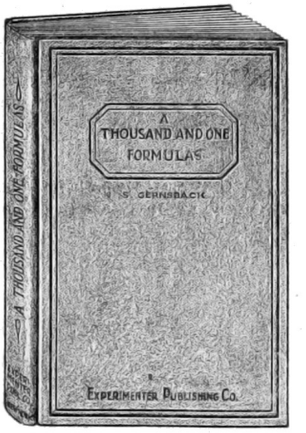

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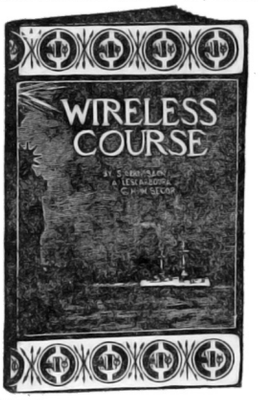

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Radio Telephony on Aeroplanes

(*Continued from page* 83)

In consequence of the greater ease of reception at a quiet ground station, and its superior transmitting power, the to-and-fro ranges became approximately equalized, in spite of the disparity of output, and a machine could speak or be spoken to at distances of the order of 70 to 100 miles.

(Abstract of paper read before the Institution of Electrical Engineers, Wireless Section, London.)

I Want To Know

(*Continued from page* 95)

0.5	17,500
0.6	20,400
1.0	31,300
2.0	47,400

TELEGRAPHIC CODES USED IN RADIO.

(200) The Junior Amateur Scientists, Brooklyn, N. Y., ask:

Q. 1. Will you please explain the number of codes employed in radio at the present day and explain the difference between the Morse Code, the International Morse Code, and the Continental Code?

A. 1. There is but one code used in radio telegraphy at the present time. This code which is known as the International or Continental Morse Code is used universally by all nations in radio work. This code consists essentially of dots and dashes in the formation of its characters. The so-called American Morse Code consists of dots and dashes and spaces in the formation of its characters. Altho this code was used in the early days of radio by Americans it is at present used solely in land wire work.

VARIABLE B BATTERY VOLTAGE.

(201) James R. Carrol, Uniontown, Pa., writes:

Q. 1. When using an audiotron vacuum tube is a variable voltage for the B battery an advantage?

A. 1. Yes, it is often an advantage as it permits of a more critical adjustment of the plate voltage during the reception of certain signals.

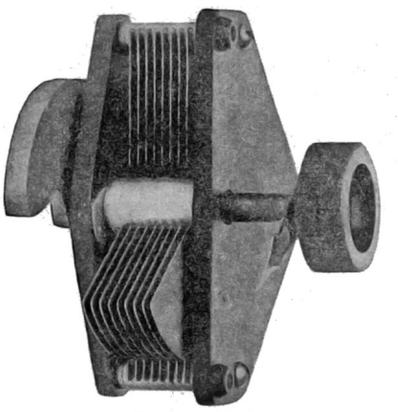
Q. 2. If a variable voltage is an advantage can a graphite potentiometer be employed to vary the voltage?

A. 2. The better way of securing variable plate voltage is to employ a multipoint switch, each switch point leading to individual taps of the B battery in a progressive manner, that is, from low to high voltage.

The Simplest Hook-Up

(*Continued from page* 86)

line from the other launch, he was grumbling in feigned exasperation. "Who is doing this long distance work with a contrivance that dynamites the ether? Let's see that infernal machine before the Radio Inspectors arrest you! Holy Smokes! Say, fellow, *you gotta tune that awning.* Its decrement is something awful!"



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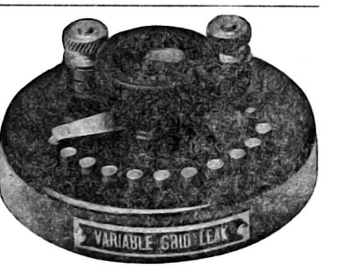

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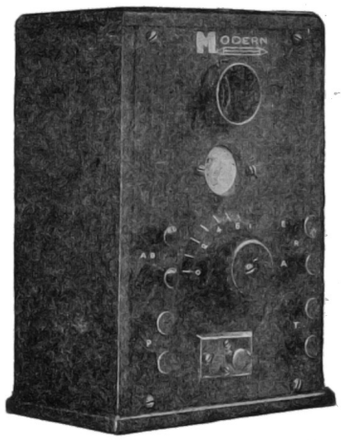

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Unjust to the Professional Operator

During the last few weeks we have received clippings from newspapers all over the country featuring "The Only Girl Wireless Operator with Sea Service." The young lady is supposed to have saved the passengers of the steamship *St. Paul* from a dire watery grave by appearing at the psychological moment and repairing the ship's "stalled wireless at sea." Another paper even went so far as to say the following: "She went aloft and got it word for word at Bar Harbor, much to the pleasure of the women on board."

Still other papers explain how the two inefficient wireless operators had "fallen down on their job" and how the young lady had saved the day, etc.

This is all very well, and no doubt makes very good reading matter for the average reader, but it is a rank injustice to the radio operators on that particular ship to be thus placed in the role of inefficient operators. In fact, our views on the matter were aptly exprest by a gentleman in a recent number of the New York *Evening Sun,* who had the following to say: "I happen to know the chief operator on the vessel in question and know, further, that he has had at least five years' experience, and during the war he was in charge of the wireless on one of our transports that was torpedoed, and I know that he was capable, trustworthy and efficient. Now, it seems to me that perhaps the young lady desired a little newspaper notoriety, and if that is the case she did not realize that she might possibly be working an injustice to men who depend on radio for their livelihood. Or, on the other hand, some news reporters, perhaps, saw a great opportunity for a story and were carried away by their enthusiasm. In any event, I think the story was harmful and unjust."

One can hardly take exception to the various news stories appearing in the daily papers, but, really, some sort of a halt should be called when the professional seagoing operator is so grossly misrepresented. It does not matter to the radio operator who reads such statements, but it does matter to the man-on-the-street. He is liable to believe that most anyone on board ship, from a ten-year-old schoolgirl to the seventeenth assistant cook, can at any time assume the duties and responsibilities of our friend "Sparks."—P. H. B.

Unconscious Humor Gleaned from Some of Our Newspapers

An audience in Ottawa, Ontario recently attended a concert at Montreal, by wireless. By means of a simplifier the concert was heard distinctly by the whole audience in Ottawa.

She went aloft and a message came from Bar Harbor for one of the passengers. She got it word for word, much to the pleasure of the women, who found in her feat grounds to base their belief that women can do as well as men in science and industry.

SOMETHING LOOSE.

FIRST RADIO AMATEUR—"You know there must be something wrong with my wireless. Every time I put on the receiver I hear a terrible rattling noise."

SECOND RADIO AMATEUR—"It must be your *loose-coupler.*"

—*Ronald Merritt.*

Was He the First Radio Man?

Mahlon Loomis, who lived in West Springfield, Mass., is credited with having sent the first aerial messages in 1865, thus antedating Marconi, who did not begin his experiments until 1895. In 1872 Loomis obtained a patent for his system of aerial telegraphy, and would today probably have been heralded as the inventor of the radio telegraphy if he had been given the proper financial support and encouragement from the public, instead of being ridiculed. As it was, Congress passed the "Loomis aerial telegraph bill" in 1873, appropriating $50,000 for further development, but the sum never reached Loomis.

Loomis made the first public demonstration of radio possibilities in 1866 from the peaks of the Blue Ridge Mountains in Virginia, fourteen miles apart. A kite was raised from each mountain with a copper wire attached to a telegraphing apparatus, and the message sent by Loomis was received at the other station as tho the two had been connected by wires.

Loomis also made successful experiments communicating between vessels in Chesapeake Bay. The vessels were stationed about two miles apart, and on each was a telegraph apparatus. Wires were attached to the instruments with their other ends thrown into the water at a moderate depth. Another insulated wire of much greater strength was thrown into a colder stratum of water. These two strata connected with the same battery made a complete circuit.—*Detroit News.*

FRENCH REGULATIONS OF RADIO AMATEURS.

According to the French Government order of Feb. 27, 1920, licenses are issued only for the reception of time signals and meterological rediograms. Transmission of any nature is strictly forbidden.

Applicants are obliged to produce evidence of their nationality. If of French birth, licenses are issued by the Regional Postal authorities. If of foreign extraction, the authority to use radio-receiving apparatus can only be granted by the Under Secretary of State for the Post and Telegraph Office. If the experimental station is to be erected within a radius of less than 50 kilometers from the frontiers or coast lines, the application is subject to the approvel of the military or naval authorities.

Applicants must furnish a short description of the apparatus which they propose to install and sign a pledge not to divulge or make use of any received message, except time signals and meteorological radios.

An annual fee of five francs is to be paid to the government, and the postoffice officials are allowed to inspect any private station at all reasonable times. Incidentally, licenses may be cancelled at the discretion of the government without any refund to the licensee.

No special restrictions are put on the length of the aerial or the use of valve apparatus.

Contributed by PROF. MOYE,
Montpellier, France.

EVIDENTLY "AT 'OM."

FIRST MOLECULE—"Do they keep close watch of all of the platinum in the Audion Bank?"

SECOND MOLECULE—"O, yes, the filament casts an ion (eye on) the plate every second."

FIRST MOLECULE—"You think it is a reliable bank, then?"

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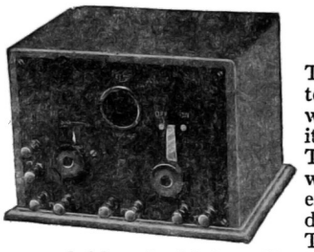
W. H. Parmly.

Audion Control Unit
only $13.75



The K. & G. Wireless Supply Co., in its efforts to place technically correct and reliable wireless apparatus well within the price reach of critical amateurs, announces its new Audion Control Unit, Type A1.

This new unit is absolutely reliable and can be used with every known circuit. It is designed and built for exacting service. It combines the very latest ideas in design with the best of material and workmanship. The cabinet, 8½x6¼x6½ has a highly polished mahogany finish and with its well mounted panel will add much to the attractiveness of your station. The unit contains these instruments: vacuum tube socket (for standard 4-prong tube) filament rheostat (10 ohms), grid condenser, grid leak, and filament switch. Panel has binding posts, suitably marked in white, for secondary, tickler, phones, and filament battery. Whole back of cabinet swings open on hinges and thus permits easy insertion of tube and batteries and complete inspection of the interior. Efficiency guaranteed, or money refunded.

Price $13.75, without tube or batteries. If your dealer can't supply you, order direct. Dealers: Write for proposition.

K. & G. WIRELESS SUPPLY CO.
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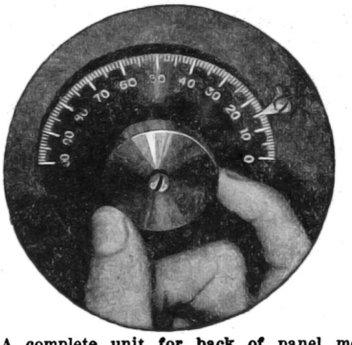

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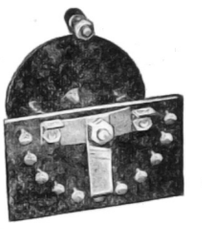

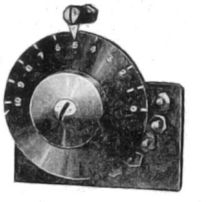

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MODULATION TRANSFORMER
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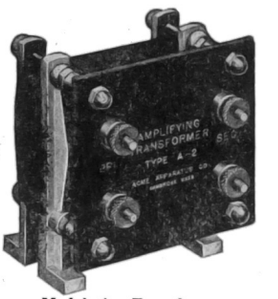

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The How and Why of Radio Apparatus. By H. W. Secor, E. E. This newest book on radio matters fulfills a distinct gap in wireless literature in that, while the treatment is made as understandable and as free from mathematics as possible, it at the same time, incorporates a wealth of technique and instruction for the Radio Amateur—the Radio Operator—the installation and Designing Expert—as well as teachers and students of the subject in general. A very broad field has been covered by the author, at the same time giving a great deal of information not found in other text-books. If you are engaged in any branch of the Radio or allied arts at all you will surely need this latest contribution to radio literature, which is destined to be found on every radio man's book shelf before long. A glance at the following list of chapters gives but a very scant idea of the extensive and useful radio knowledge provided in its text: The Induction Coil; The Alternating Current Transformer; Radio Transmitting Condensers; The Spark-Gaps; Radio-Transmitting Inductances; Radio Receiving Tuners; Radio Receiving Condensers; Detectors; Telephone Receivers; Radio Amplifiers; Construction of a Direct Reading Wavemeter and Decremeter; Antenna Construction; The Calculation and Measurement of Inductances; Appendix containing very useful tables, covering all subjects treated in this very unusual book. This newest of Radio Works, cloth bound in Vellum de Luxe, Gold stamped and Hand Sewed, has 160 pages. Size of Book 6x9 inches. The How and Why of Radio Apparatus, Postpaid, $1.75. Experimenter Publishing Co., Book Dept., 236-A Fulton Street, New York.

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Wireless Course in 20 Lessons. By S. Gernsback, A. Lescarboura and H. W. Secor, E. E. Tells you everything you want to know about "Wireless"—theory, practise and history. A clear, concise course on every phase of this subject; 160 pages—350 illustrations, 30 tables. Flexible cloth cover, 75c. postpaid. Stiff cloth cover, $1.25 postpaid. Experimenter Publishing Co., Book Dept., 236-A Fulton St., New York.

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The How and Why of Radio Apparatus—By H. W. Secor, E. E.—This newest book on radio matters fulfills a distinct gap in wireless literature in that, while the treatment is made as understandable and as free from mathematics as possible, it at the same time incorporates a wealth of technique and instruction for the Radio Amateur—the Radio Operator—the Installation and Designing Expert—as well as teachers and students of the subject in general. A very broad field has been covered by the author, at the same time giving a great deal of information not found in other text-books. If you are engaged in any branch of the Radio or allied arts at all, you will surely need this latest contribution to radio literature, which is destined to be found on every radio man's bookshelf before long. A glance at the following list of chapters gives but a very scant idea of the extensive and useful radio knowledge provided in its text: The Induction Coil, the Alternating Current Transformer, Radio Transmitting Condensers, the Spark-Gaps, Radio-Transmitting Inductances, Radio Receiving Tuners, Radio Receiving Condensers, Detectors, Telephone Receivers, Radio Amplifiers, Construction of a Direct Reading Wavemeter and Decremeter, Antenna Construction, the Calculation and Measurement of Inductances, Appendix containing very useful tables, covering all subjects, treated in this very unusual book. This newest of Radio Works, cloth bound in Vellum de Luxe, Gold Stamped and Hand Sewed, has 160 pages. Size of book, 6 x 9 inches. The How and Why of Radio Apparatus, postpaid, $1.75. Experimenter Publishing Co., Book Dept., 236-A Fulton St., New York City.

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(*Continued on page* 126)

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If you hope to become a Licensed Radio Operator and reap your share in the opportunities of this wonderful field, it is important that you get your training in a high-grade radio school.

Our course in Radio Telegraphy, under the direction of S. W. Edwards, U. S. Radio Inspector, offers the kind of instruction that makes for success. New, complete equipment. Reasonable tuition. Day or evening courses. Opportunity to earn expenses while here.

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(Continued from page 125)

Exchange—(Continued.)

Sell or Exchange for house wiring material. New electron relay, $4. Electron relay control cabinet, complete, $3. Crystaloi detector, $2. Loose coupler, 3000 meter, $3. Telephone material cheap. Ralph Leffler, Tiffin, Ohio.

For Sale—Omnigraph No. 2 Jr., $10.00. Fifteen extra dials wireless code, $2.00. Total, $11.00. George A. Wilson III, 650 Gooding St., La Salle, Illinois.

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Wireless and experimental apparatus for sale or trade. List upon request. Want wireless sending apparatus for short wave regenerative receiver. All answered. Oodles of material for doing your own construction work. R. Disheroon, 893 Park Ave., Hot Springs, Ark.

Exchange—1 Set Marconi Wireless Records for 1 Mounted Receiving Transformer. John Timmons, 3 Ninth Street, Brooklyn, N. Y.

For Sale—Two Western Electric V T 1 bulbs, new, $9 each. Can use amplifying transformers, Marconi jars and Hyrad disc. Box 482, Youngstown, Ohio.

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For Sale—Rotary gap; never been used. First $7.50 in cash with order gets it. Glenn Shockley, Silverton, Oregon.

Asta—For Sale, W. I. Co. Type 106A Audion panel; pair Baldwin Type E phones; Hammond portable typewriter, latest model, interchangeable type; new and as advertised. Used only two trips. L. H. Simson, 512 East 4th St., Hood River, Oregon.

For Sale—Wireless and Electrical goods. Send stamp for list. Norman Shaffer, Norwich, Conn.

For Sale—Omnigraph No. 2 junior, extra dials, practice set, telephone. Address "Radio," 601 21st St., N. W., Washington, D. C.

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Wanted: Grebe or Paragon regenerative receiver. Thomas King, Island Park, Dayton, Ohio.

Camera, $5; numbering machine, $7; microscope, $12. Durso, Dept. 50, 25 Mulberry, New York City.

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For Sale—Sending and Receiving Set with aerial, $15.00. Description for stamp. Ralston Boone, 124 Wythe Ave., Bluefield, W. Va.

Exchange—(Continued.)

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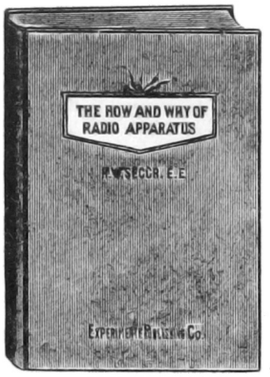

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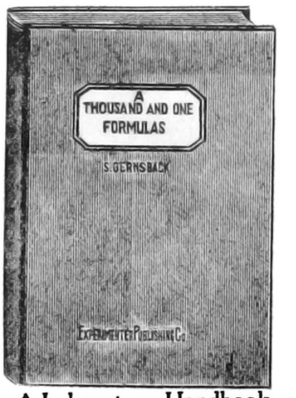

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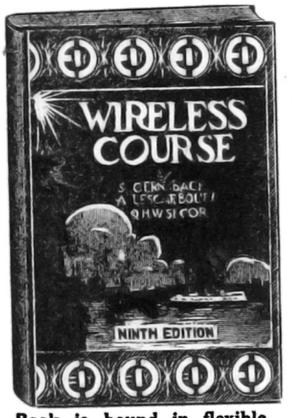

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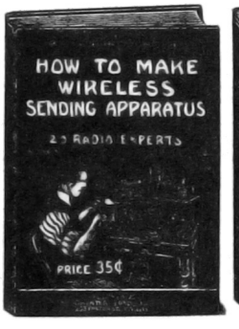

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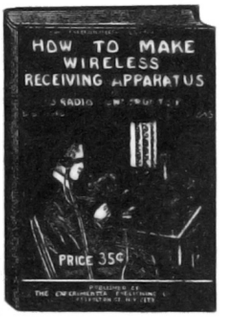

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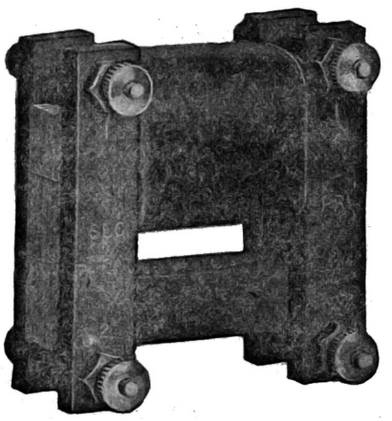

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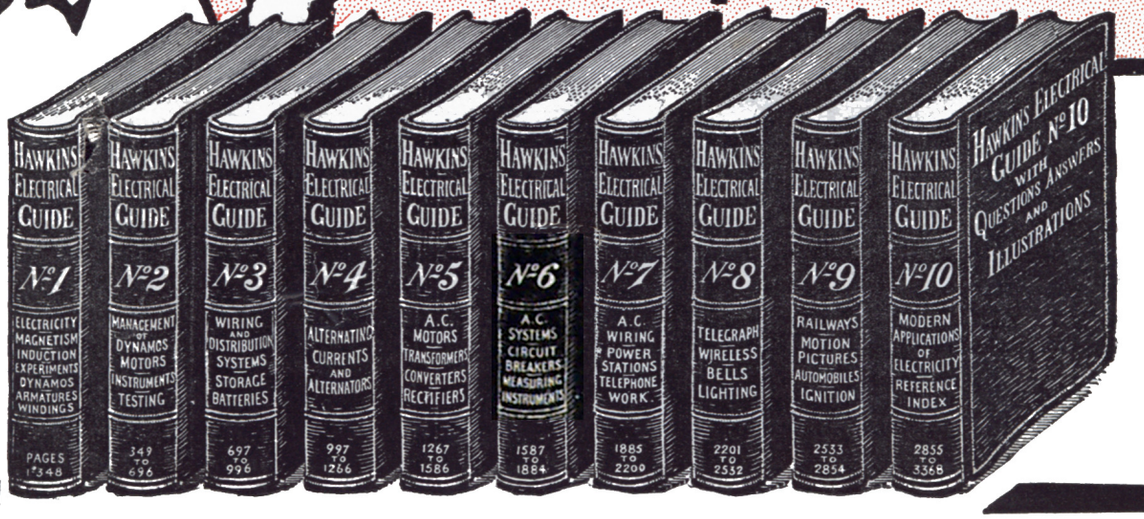

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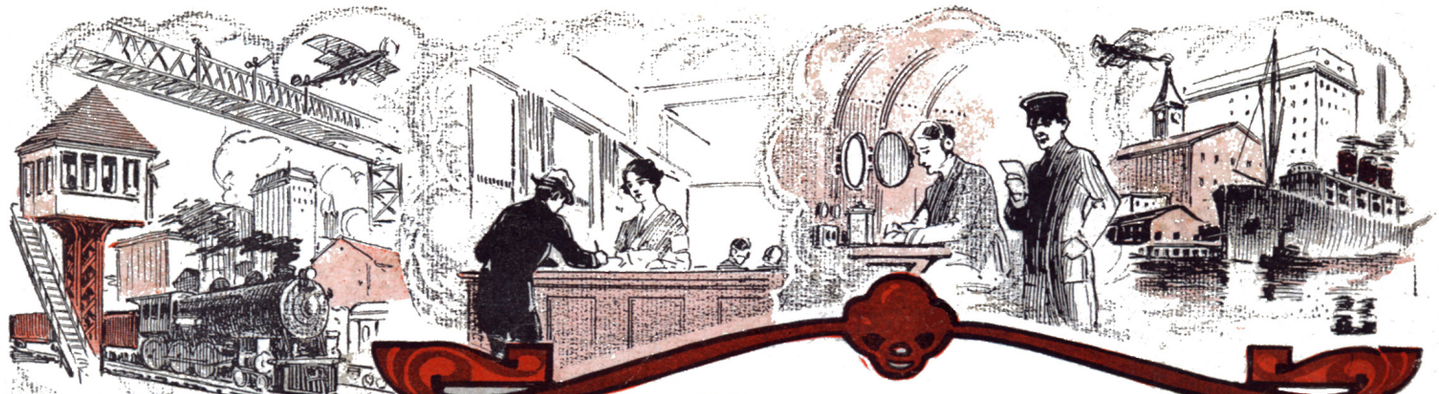

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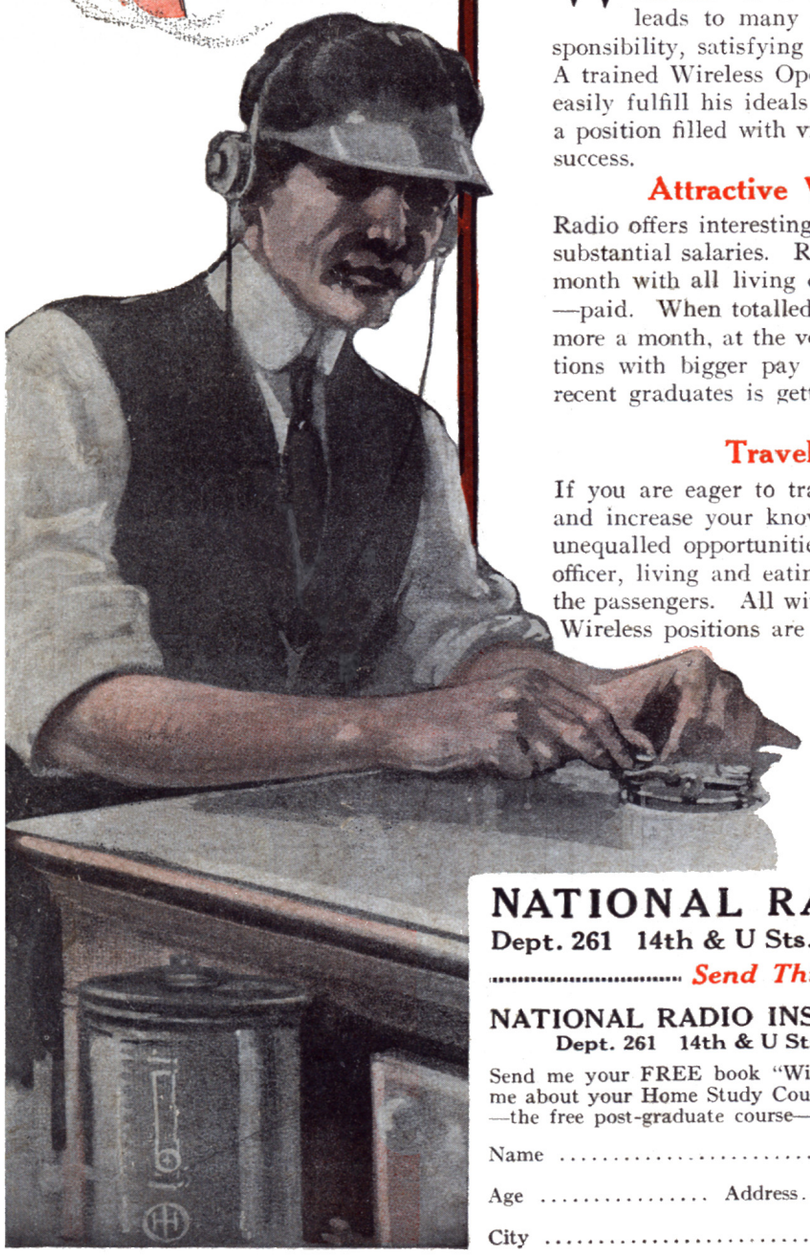

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